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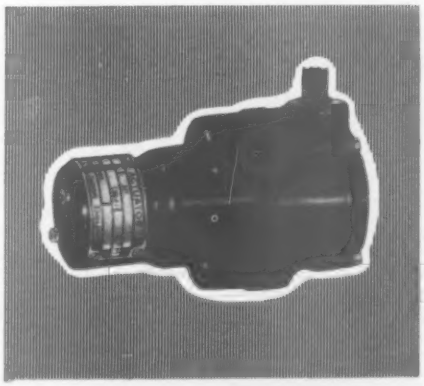

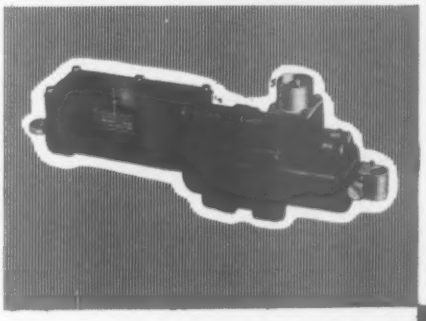

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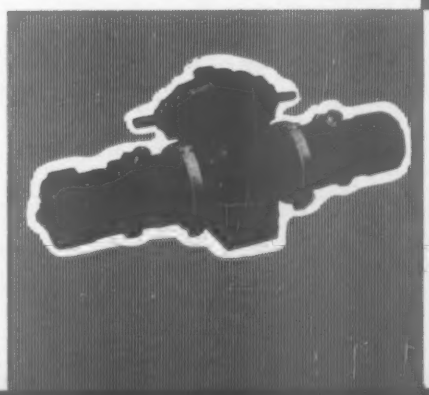

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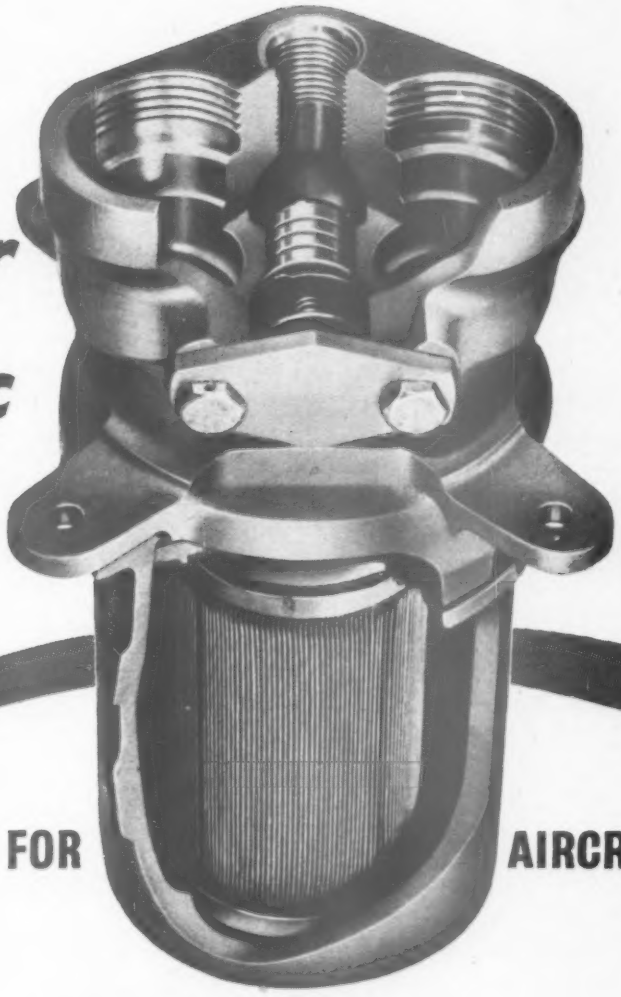

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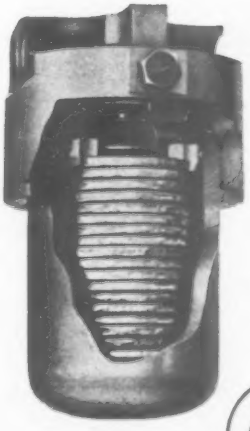

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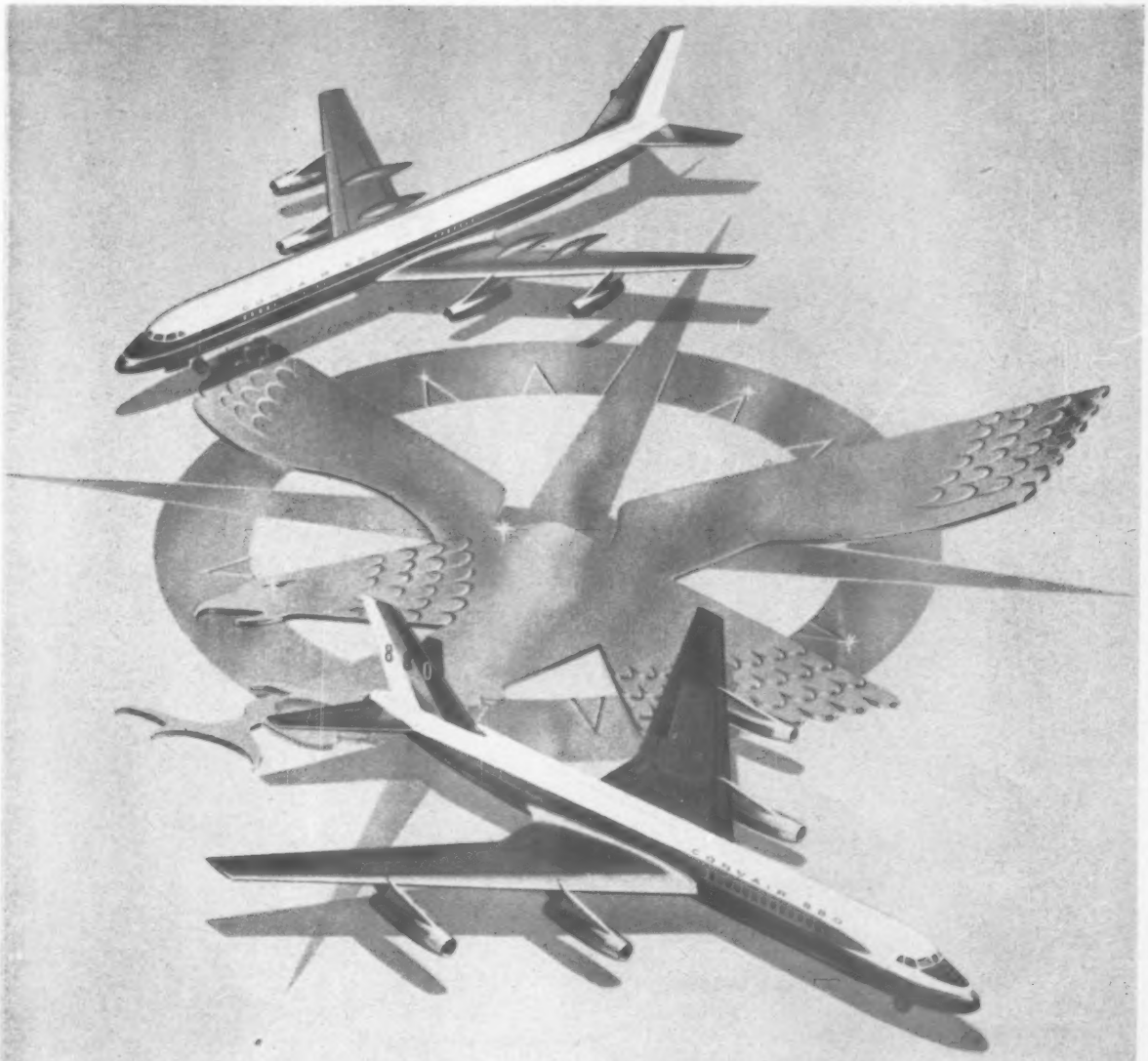

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Photo by courtesy of B.E.A.

Inspecting a Viscount at London Airport: one of a fleet of 40 ft. Hydraulic Platforms owned by B.E.A.

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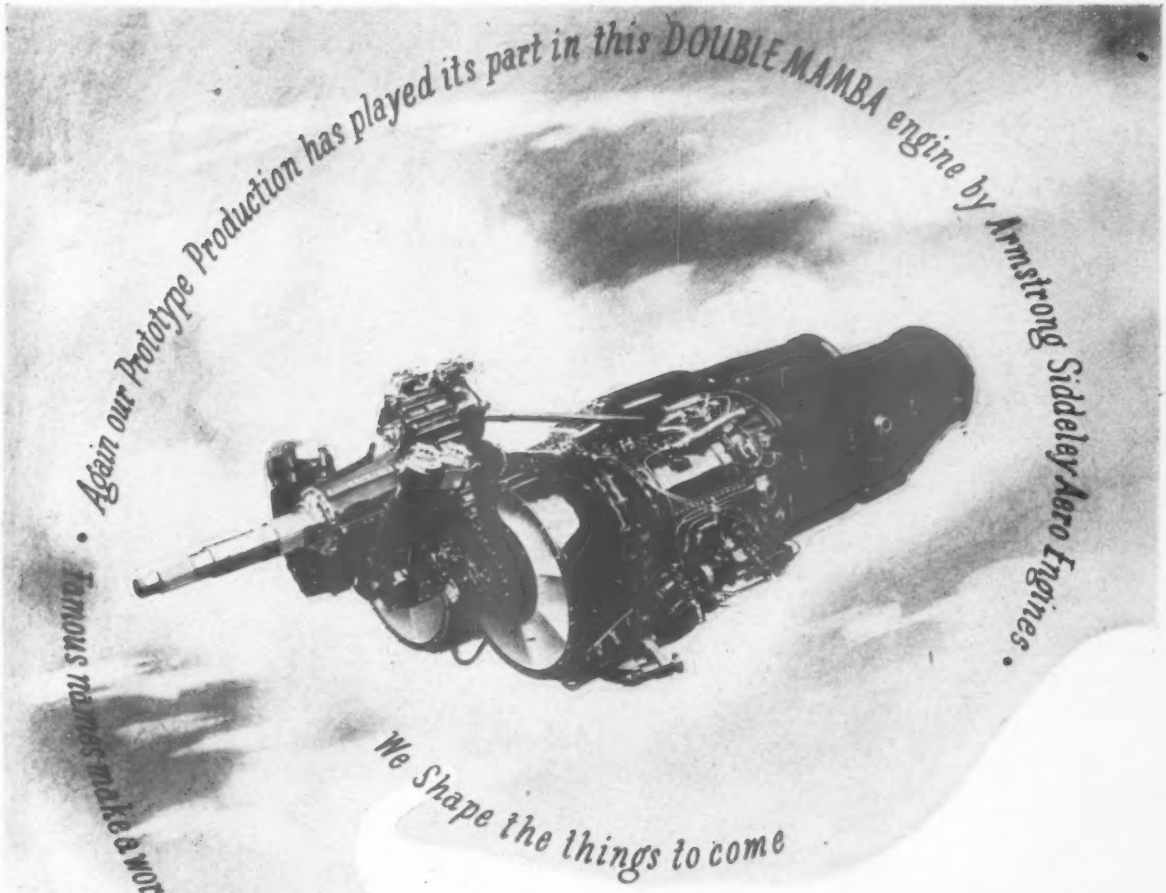
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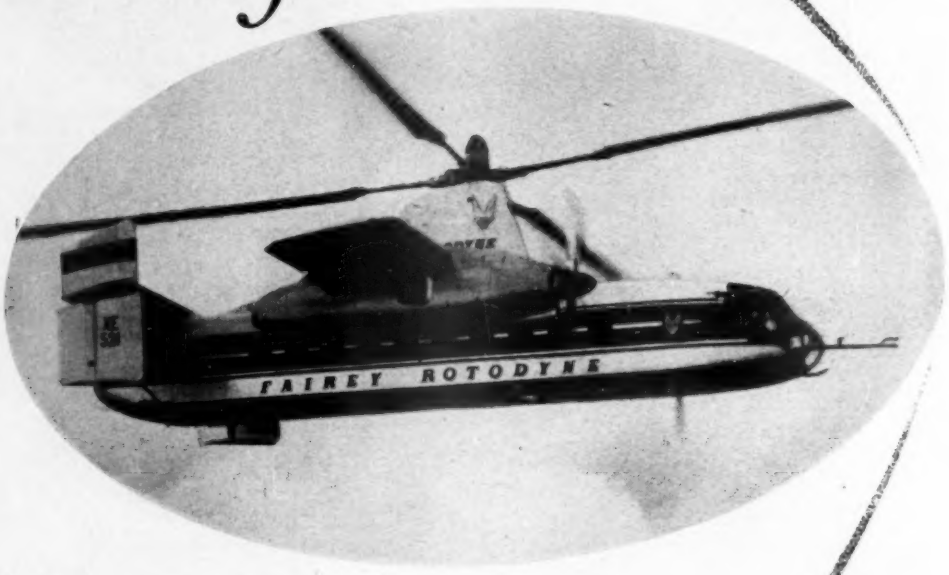

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This record, almost 30 m.p.h. faster than the corresponding helicopter record and 30 m.p.h. faster than the absolute speed record for helicopters, confirms Fairey's claim that the true V.T.O. airliner is here, now, for city-centre to city-centre journeys, needing no expensive airfields, wasting no valuable time.

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THE AEROPLANE and ASTRONAUTICS

VOLUME 96 NUMBER 2486 APRIL 24 1959

Out Into Space

With this issue a decisive step has been taken to mark the changing times in which our aircraft industry and its associate industries find themselves. Transportation by aeroplane continues its vigorous progress: last year more than ninety million people travelled by air.

As an annual passenger increase of 15% is foreseen the civil market must be expected to go on demanding more aeroplanes. Civil operators have already voiced their belief that in 10 years time the supersonic airliner will be there for them to operate.

On the military side those in authority in the Fighting Services reiterate their belief in the continuing future of manned aircraft in association with the rapidly developing unmanned long-range ballistic missiles. But for some time past developments of guided missiles in the guise of satellites and space probes have demonstrated man's new-found power to explore space with man-made instruments. These activities may well be grouped under the term "Astronautics" which, according to the Oxford Dictionary, means "the science of aerial navigation in space."

This is the term which has been chosen to complement the title which for 48 years has stood alone as the name of this paper. The joint title of THE AEROPLANE AND ASTRONAUTICS indicates to readers old and new the wide field which from now on it is our intention to cover. To this end the editorial team is being reinforced by the experienced aid of Mr. Kenneth Gatland, vice-chairman of the British Interplanetary Society and editor of the B.I.S. journal *Spaceflight*. His help will ensure that a regular section devoted to Astronautics and Missiles shall appear every week to supplement the technical coverage of aeronautical subjects.

In accord with the spirit of the change, certain re-arrangements have been made in the presentation of this page and other regular features to make them more readable.

We have branched out into space in both senses.

Editor - - - THURSTAN JAMES
Deputy Editor - - F. T. MEACOCK

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Nothing but the Best

The news—recorded on p. 500—that members of the Royal family may fly regularly in the Comet 2s of R.A.F. Transport Command on some of their longer journeys is, at the same time, both encouraging and otherwise.

It is good that Transport Command should be honoured and, in this way, confirmed in its increasing strength and use of modern vehicles; but we cannot help but feel unhappy at the thought that the Royal family should be travelling in relatively obsolescent turbo-jet transports while their subjects travel in the latest aircraft of the same name.

How much better it would be if Transport Command could operate Comet 4s as well as Comet 2s and Britannias and, at the same time, be able to gain experience with even more modern types of aircraft

—and even to be used, as the Command surely should be, for development and proving work with civil aircraft still to go into airline service.

Commercial Nonsense

Every year, production engineers forgather at Southampton University for a two-day conference on aircraft matters. Usually there emerges from this conference some outspoken expression of opinion drawing a sharp perspective on some topic of current interest. This year—the seventh of the series, held on April 16 and 17—was no exception and it was Mr. P. G. Masefield's forthright comments on the recommendations of the committee who studied the supersonic civil transport possibilities that deserve the limelight.

Although, he said, the proposals for a Mach 1.2 and a Mach 1.8 aircraft would make sense in a non-competitive world they make commercial nonsense in a competitive one where it must be expected that America and Russia are pressing forward with very much more advanced aircraft. Whatever the merits of particular speeds analysed, as he put it, *in vacuo*, it was "commercial folly" to shut one's eyes to what was going on elsewhere.

This question of the British aircraft industry's possible entry into the supersonic transport business was, in fact, one of the major talking points of the conference. And just as there was general agreement with Mr. Masefield's sentiments regarding the choice of speed category, there was a generally similar note of caution in the views expressed about the desirability of tackling such a task.

Mr. Masefield himself suggested that all the implications should be most carefully studied by a high-level committee. This, he proposed, should be constituted on the lines of the Brabazon and Cadman Committees and charged with the duty of making a fundamental and widespread review of the whole status of British aeronautics.

Inevitably, of course, in the context of the supersonic airliner discussion, the matter of prestige was raised and the view was expressed that if we gave up the idea of producing such a craft and of doing the advanced research that would go with it, there would be a danger of the aircraft industry becoming the producer of uninspired freight-carrying aircraft which might be economical but which would lower our technical status. This must not be.

Rocketeering for Teenagers

When new and imaginative forms of engineering or applied science become publicly known, it is nearly always axiomatic that very soon afterwards some members of the younger generation will express their close interest in it with the production of models of one sort or another. In this respect, it was only to be expected that the imagination of youngsters the World over would be stirred by the knowledge of satellites in orbit and of the development of guided missiles and other rocket-powered devices.

Nowhere are these activities more widespread, or advanced, than in America; and throughout the States youngsters—ranging in age mostly from 13 to 17—have developed, built and fired test rocket vehicles of their own design. This wide interest and a spate of questions directed to the military services, has, in fact, led the U.S. Department of the Army to take active steps to put it all on a properly organized basis.

In point of fact, last year a directive was issued whereby the Army at all levels was authorized to co-operate with amateur rocket clubs, and missile and other scientific groups, in the development, construction and testing of rockets and similar explosive items. To this end the U.S. Army has been supplying information, arranging conferences and providing firing ranges. Furthermore, to provide serious students with professional instruction and guidance in the basic sciences and special technologies relating to the design and construction of rockets and allied systems, courses are being offered jointly by the Army, engineering and research staffs of industrial concerns in the missile field, and leading educational institutions.

A few weeks ago junior rocketeers in America had the opportunity of firing their models for the first time on an Army range. A large party of these youngsters with some parents and "official" advisers were transported to Camp A.P. Hill, near Bowling Green, Virginia. And of 50 rocket models launched about one-third were successful.

This American recognition of the worth of stimulating and controlling the interest of the younger generation in the scientific and technological aspects of missiles and astronautics is an example that could well be followed. There are a good many youngsters in this country, too, who are keen to do some practical small-scale experimentation in rocketry. To encourage them in this and to direct their enthusiasms along proper lines would do much towards educating the next generation of rocket engineers and scientists.

Here is a chance for the A.T.C.

At a dinner, to be given in his honour by the Royal Aero Club on April 30, Lord Brabazon is to receive a silver model of the aeroplane on which he made his first flight 50 years ago.

Revising Accident Investigation

There will undoubtedly be some good results from the discussions of the matter of pilot's rights in the House of Commons on March 25 and on April 16; the details of this exchange between Sir Lionel Heald and Mr. Watkinson are summarized on p. 494 of this issue.

Although the complaints of injustice in this particular case were, in our view, somewhat limited in validity, the principles involved were, as they always have been, of great importance and it was a good thing to have had this subject of accident investigation, method, and responsibility allocation, thoroughly aired. From this series of interchanges in the House there may well stem revised regulations and even, it may be hoped, new principles of investigation.

Not that anyone would suggest that the Ministry of Transport's accident investigation department is, within the limitations of the methods used, anything but scrupulously fair and impartial. The report on the Prestwick accident, for instance, was both just and considerate. Those who have read this report in detail will agree that maximum emphasis was laid on mitigating circumstances and that care was taken to explain these in great detail.

Nevertheless, any form of investigation which is held in camera and which is under the control of a limited number of individuals is liable to bias and also, even, to the influence of policy decisions in various quarters. Where matters of safety and of personal reputation are involved it is essential that justice, technical or otherwise, should be seen by all to have been done.

Matters of Moment

R.A.F. Launch Their First Thor

A BIG step towards operational status for Thor IRBMs in Britain came on April 16, when, for the first time, an R.A.F. crew played the main rôle in a Thor IRBM launching. In this successful training launch at Vandenberg AFB the three key figures were all R.A.F. personnel. They were the launch control officer, Sqn. Ldr. P. G. Coulson, the launch monitor-console operator, Master Pilot M. H. Sloan, and the missile maintenance technician, Chief Technician R. M. Carpenter. Another R.A.F. launching crew stood by during this firing, the preparations for which were made by R.A.F. and USAF technicians who receive "integrated weapons system training" at Vandenberg.

The Thor, resplendent in its coat of white paint and carrying an R.A.F. roundel, rose from its launching pad in sand dunes beside the sea and after ascending vertically headed out due west over the Pacific. An hour later it was announced that it had landed in the target area; the programmed range for the test was not announced.

The launching had originally been scheduled for the previous day, but was postponed initially because of low cloud and then, at a late stage in the countdown, by technical trouble, details of which were not given. Facilities for all-weather and night-time tracking of missile launches at Vandenberg are being installed, but at present visual observation is essential to ensure that missiles do not veer from their programmed course.

This Thor launch was the second training one to be made by military personnel; the first was on December 16, 1958. In all there have now been 40 firings of Thor IRBMs and Thor-based research and space vehicles. Current reliability of Thor is shown by the fact that in the last nine firings of Thor and Thor-based vehicles such as Thor-Able all would have satisfied the military operational requirements for the IRBM.

Vandenberg AFB, where this Thor was launched, is both an operational and training missile base of Strategic Air Command. It is on a remote part of the California coast 168 miles north of Los Angeles and extends over 64,000 acres. This vast, sandy area on the Pacific coast is possibly the most important military missile base in the U.S. It is to be the first operational Atlas base and is also responsible for training to achieve the "initial operational capability" with both IRBMs and ICBMs. Atlas launchers have been installed there and Thor, Atlas and Titan training programmes are under way.

R.A.F. men go to Vandenberg for the final phases of their Thor training. Earlier training is given in Thor guidance at Milwaukee by AC Spark Plug, in propulsion by Rocketdyne at Santa Susanna and airfire and checkout training by Douglas at Tucson. At present there are 280 R.A.F. personnel under training at Vandenberg. The senior R.A.F. officer there is Gp. Capt. Frogley, who commands the third R.A.F. Thor squadron. Equipment for this squadron is now arriving in Britain. A progress report on Thor is on pages 501-503.

Further training launches by R.A.F. crews will be made from Vandenberg; the next is scheduled for May. The Thor which will be launched then was on view when Mr. Cownie, of THE AEROPLANE AND ASTRONAUTICS, visited the Thor RIM (receipt, inspection and maintenance) building at Vandenberg. This missile—Thor number 191—was being given its pre-liminary checks by a crew of R.A.F. personnel. Training is necessary in no fewer than 21 technical grades for Thor operation, but cross-training in the different specialities is given both in Britain and in the U.S.A.

A Super Bloodhound

IN the recently published Air Estimates it was announced that a new high-performance surface-to-air missile is to be ordered by the R.A.F. for the defence of this country. It can now be stated that this weapon is a developed version of the Bristol/Ferranti Bloodhound as in R.A.F. service.

That the R.A.F. intends to employ a later version of the same missile system is significant for two reasons: the realization that the Bloodhound has in itself the required potential development, and that, for national defence, as a single weapon system, it will be able to keep pace with and counter the threat as it changes.

Significant also is the indication that the R.A.F. proposes to keep pace by development of a selected system rather than by replacement, a policy that was largely followed during the Second World War with manned aircraft. In the case of a missile system this decision is even more advantageous operationally and economically.

The new missile will have a substantially increased operating range and height. Advanced techniques will also ensure greater lethality, and low-level performance to counteract low-flying targets will also be improved. Illustrations appear to indicate that it has larger wings than the standard Bloodhound.

Mr. A. P. Chalkley

WE regret to announce the death in London on April 19, following an operation, of Mr. A. P. Chalkley at the age of 73. Mr. Chalkley, who was editorial director of Temple Press Limited, had been editor of *The Motor Ship* for 39 years.

LAS VEGAS DISPLAY.—A view of McCarran Field, Las Vegas, last week, with the display of civil aircraft in the right foreground. Readers may like to try their skill in identifying the aircraft shown. They include a "civilianized" RY-3 Privateer, a four-engined Grumman Goose, Convair 440, Canadair 540, Fairchild F-27, Lockheed Electra, Convair 880, Douglas DC-8 and Boeing 707; military types include the KC-135, B-47, RC-121D, Vulcan, Comet 2, B-58, F-101, F-104, F-105 and F-106.

WEIGHT LIFTER.—The Westland Westminster heavy-duty helicopter lifts a section of an Army assault floating bridge. This load weighs 6,736 lb. is 35 ft. long and 20 ft. wide.

News from France

RECENT reports that the West German Government had signed a contract with Sud-Aviation for 130 Alouette helicopters—at a price of around £16,000 each—formed an enviable background to the lecture in London recently by Mr. F. L. Legrand on French helicopter development. In his paper to the Helicopter Association of Great Britain, he revealed that in 1958 there were no fewer than 3,000 people in France concerned with helicopter production and associated work. And Sud-Aviation—the only French company engaged in helicopter research and manufacture—delivered in that year no less than £6 million worth (£1.3m. worth as exports) of these machines; this represents 13% of the overall production of the company.

Mr. Legrand spent the major part of his paper describing in detail the Djinn and the Alouette, as contributors to these healthy totals, and he discussed the latest versions of them. But to the majority of his listeners the most interesting part of his paper was that in which he had something to say about the new S.E.3200 three-engined general-purpose helicopter.

This, in the case of the prototype, is powered by three Turboméca 800-s.h.p. Turmo 3B free-turbine engines, but production versions will have the more powerful Turmo 3C engines—normally giving 1,100 h.p. but de-rated for the S.E.3200 to give 900 h.p. Location for these three engines follows what has come to be the usual practice and they are mounted atop the fuselage.

All three are in the vicinity of the main reduction gearbox but two of the engines are side-by-side in front of the rotor while the third is behind it. Fuel for the powerplant is housed in two jettisonable tanks situated on each side of the fuselage, low down.

According to Mr. Legrand the classical "single rotor plus tail anti-torque rotor" layout was chosen primarily because one of the planned duties of the machine was ship-board operation. This meant keeping the overall dimensions as small as possible and, for the same reason, dictated the use of a comparatively high disc loading. Another reason given for choosing this layout was the need to minimize manufacturing and maintenance problems connected with the transmission and blades.

The acceptance of a high disc loading would, of course, be offset by the choice of a three-engine powerplant which gives a satisfactory engine-out performance.

Three principal types of duty are envisaged for the S.E.3200. In army ground support missions, it should be suitable for assault troop carrying or logistic transport and as an ambulance. For naval duties, it is intended for anti-submarine work and mine-sweeping. And for civil use it should prove suitable as a city-to-city transport with accommodation for 20-30 passengers depending on the range required.

The prototype S.E.3200 was rolled out of the factory earlier this year and was put through an intensive ground test programme before making its first flight. Testing of the second prototype, says Mr. Legrand, is due to begin soon.

Design Data

DIMENSIONS.—Rotor dia., 49 ft.; length o.a. (blades folded), 49 ft.; width o.a. (blades folded), 17 ft.; height o.a. (blades folded), 15 ft. 5 in.; cabin length, 23 ft.; cabin width, 6 ft. 3 in.; cabin height, 6 ft.

WEIGHTS.—Empty (standard version with radio and navigation equipment), 9,900 lb.; normal gross, 16,500 lb.; overload gross, 17,600 lb.

PERFORMANCE.—Max. speed, sea-level, 160 m.p.h.; cruising speed, sea-level, three engines, 150 m.p.h., two engines 130 m.p.h.; hovering ceiling, 5,900 ft.; service ceiling, 10,800 ft.; max. range on three engines, 620 miles, two engines, 745 miles.

Matters of Moment . . . .

Dining in the City

AVIATION and aeronautical engineering were well represented at the Livery Dinner of the Worshipful Company of Coachmakers and Coach Harness Makers on April 14. One could not help but feel that the quiet panelled dignity of the historic Grocers' Hall was as far removed from the modern forms of surface and air transport as it was possible to get. As a setting to the assembled company of distinguished members of the Livery and their guests and ladies, it was an effective reminder that when history and tradition cease to become potent factors in our way of life, progress will indeed have ceased.

Among the guests present on this occasion were Sir Aubrey Burke, K.B.E., president of the Society of British Aircraft Constructors, and Lady Burke. The Guild of Air Pilots and Air Navigators was represented by its Master, Sir Frederick Tymms, K.C.I.E., M.C., F.R.Ae.S., and Lady Tymms.

Following custom, the Lord Mayor was the principal guest to whom the Senior Warden, the HON. DENIS BERRY, T.D., proposed a toast. In reply the Lord Mayor, SIR HAROLD GILLETT, M.C., T.D., referred to the value of the Livery Companies and spoke of the City of London as a great bastion in a rather difficult world.

The toast to the Worshipful Company was proposed by the RIGHT REVEREND BISHOP H. A. WILSON, C.B.E., D.D., who took a cue from Sheridan and succeeded with admirable brevity.

MR. R. J. D. SMITH, the Master, in reply, spoke of some of the guests the Company had entertained during the past 18 months. Among them had been the officers of H.M.S. "Centaur" and members of the Air Council. A year ago the Company had presented "Centaur" with a drum major's outfit for ceremonial use and more recently had given the ship a silver bugle.

Capt. Horace Law, in writing to thank the Company for these gifts had expressed the thought that as the ship was more likely to perish before the Coachmakers, they should be returned to the Company when Her Majesty's Lords of the Admiralty decided that the services of the ship were no longer required. Mr. Smith said that he had replied to Capt. Law saying that he hoped that the day when their Lordships decided that they had no further use for "Centaur" might long be deferred. And he spoke for all those present in his further hope that both the ship and the Worshipful Company might continue to flourish for ever.

MR. ROLAND E. DANGERFIELD, Past Master, proposed a most lively toast to the guests. He welcomed particularly the ambassadors of France, the United States and Portugal, and their ladies. He also welcomed the Masters of five other Livery Companies who were present, and distinguished members of the Services.

COL. A. E. YOUNG, C.M.G., Commissioner of Police of the City of London, speaking in place of Lord Justice Ormerod who was unable to be present, made a most entertaining reply on behalf of the guests on whose dignity and decorum he commented. He paid a specially gracious tribute to the charm and beauty of the ladies; and spoke for all the guests in his reference to the pleasures of a memorable evening.—F.T.M.

An Italian Aviator

THE death of Gen. Mario de Bernadi is reported from Rome. He was 65.

He was one of three Italian pilots who flew in the Schneider Trophy contest at Hampton Roads, U.S.A., in 1926, and subsequently proved to be the winner, flying a Macchi M.39 at 246.5 m.p.h. In the following year he set up a World's seaplane record of nearly 297 m.p.h. in a Macchi M.52 which he had piloted in that year's Schneider contest.

Throughout his life de Bernadi maintained the closest association with aviation. He had flown as a scout pilot in the First World War, and in 1941 piloted the experimental Caproni-Campini jet-propelled aircraft. A few years ago he designed the small Air Scooter monoplane powered by a 125-c.c. engine. He had been flying this over Rome on April 8. On landing he collapsed and died.

Private Enterprise Heliport

OPENING of the Westland heliport at Battersea was planned to take place on Thursday, April 23. The opening ceremony by Mr. John Hay, Joint Parliamentary Secretary, Ministry of Transport and Civil Aviation, must be regarded as the culmination of nearly nine months' work and an expenditure of some £60,000.

Manufacturers of helicopters and operators of VTOL aircraft have every reason to be grateful for the determination and enterprise shown by Westland in providing the great metropolis of London with a heliport so that members of the public can take advantage of the mobility conferred by the only vehicle which can get in and out of cities without adding to the congestion on or under the ground.

For reasons which will be familiar to many and will be touched on later, the new site had perforce to be adjacent to the River. Approaches had to be as open as possible and remote from residential and office areas. These requirements have been met in a remarkable way by a site on the south bank midway between the road bridges of Battersea and Wandsworth. And the surroundings are industrial installations except on one side.

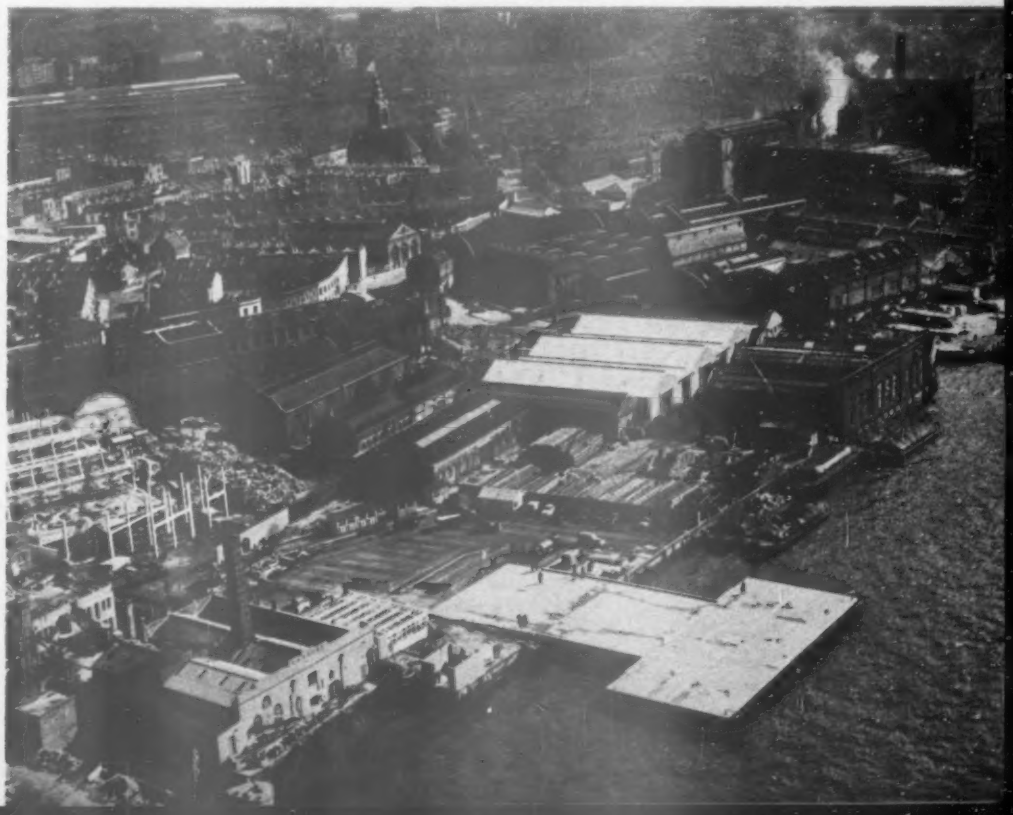
It is thus not far from the mainline station of Clapham Junction. Its position in relation to Victoria and Waterloo stations is shown on the map overleaf. To make the site ideal, close proximity of an underground station would be required. On the other hand, passengers able to charter helicopters at prevailing rates are certainly not going to burke at paying for taxis or cars to complete their journey.

In spite of the apparent ease with which helicopters can get into, and out from, confined areas, considerable provision has to be made to meet the requirements of the authorities even for a private user licence, which is what Westland have been granted.

There is the question of suitable approaches bearing in mind consideration of prevailing wind and the effect of turbulence in the lee of tall buildings and high chimneys. There is the matter of adequate structural strength to withstand the landing impact of heavy helicopters. Besides fuelling provision, there is the question of fire-fighting and rescue from the water. Both contingencies have been met.

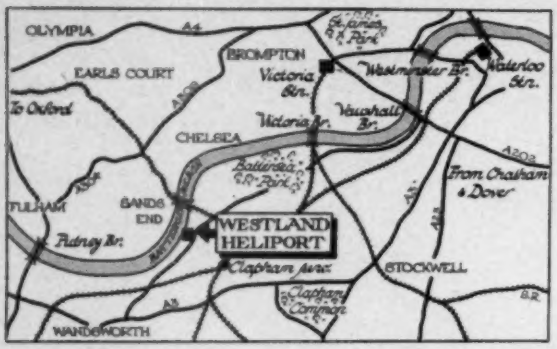
It is to be noted that air traffic requirements limit the ceiling of helicopters using the River to 500 ft. As the upper limit of a helicopter's safety envelope may be 400 ft., precise control of the approach height is essential. It is most interesting when approaching the site along the River to find how narrow it seems in such conditions. The low ceiling is of course dictated by the need to ensure clearance for the airliners coming in and out of London Airport.

Control is in the experienced hands of Aeradio and in this connection the control room is provided with radio links. The control room, reached by an external staircase, being adjacent



Above, a Westland Widgeon over the 21-in. thick concrete landing and take-off pad. Right, this aerial view taken while coming in from the N.E. shows the layout of the heliport with the landing pad over the water and the servicing area on land.

Photographs copyright "The Aeroplane and Astronautics"



to the vertical face of the river wall, ensures an unobstructed view of the landing platform, helicopter approach and take-off paths, river traffic and parking area.

There will be a duty staff of two provided by Aeradio who will operate the 123.3 megacycles air/ground radio link and the telephones to London Airport and Kingsway. They will also cover the other duties including that of looking after passengers. In the early stages of operation of such a novelty for this country as a heliport the functions of the staff on duty will clearly have to be pretty flexible.

Reference has been made to the parking area; this is large enough to accommodate up to five 8-seat helicopters without folding rotorblades. The two adjacent car parking areas can take up to 20 cars.

Two underground storage tanks, one of 5,000 and the other of 3,000 gallons' capacity provide bulk storage for gas-turbine and petrol fuels respectively. Supplied by Shell-Mex and B.P., Ltd., this refuelling installation is located adjacent to the upstream edge of the parking area ramp. Replenishment of the underground tanks is either through manhole-enclosed filler pipes directly above, or alternatively from offset filler points located just off the downstream edge of the ramp.

The surface area in the vicinity is dished to trap any spillage which may occur during filling operations. To meet a local requirement the above-ground filler pipe caps and their appropriate manhole covers extend above the highest recorded river flood level.

Two 16-ft. high vent pipes are located at a position on the upstream river wall where they do not create an obstruction. Here they are supported by a metal post, which also serves as a rigid attachment for a windsock.

Design of the electrical installations covering immediate and longer-term lighting and power requirements has been undertaken by the General Electric Company. To ensure safe ground movement of helicopters, vehicles, and personnel at night, the main illumination is provided by four 1-kW. sodium floodlights mounted as a group on a 40-ft. high tripole mast positioned immediately behind the control room. The beams from these lights are screened to preclude penetration of the landing platform "T."

Subsidiary low-level external single light points located along the northern and southern boundary walls provide additional or alternative local illumination to the entrance gate, the car and helicopter parking areas. Similar lights are also positioned to illuminate various entrances to the passenger building and to the slipway approach steps.

Various lighting and power points with wander-lead socket attachments are positioned around the periphery to facilitate helicopter maintenance and the use of ancillary services.

Proposals for platform lighting to permit limited night-flying activities by charter operators under normal visibility conditions are now being considered by M.T.C.A. These seek to provide planform definitions of the alighting area by appropriately coloured lights around the periphery, and low-level flood lighting of the surface for height and texture definition. All-weather round-the-clock operational activities will necessitate provision of a more elaborate lighting array.

A minor problem associated with night-flying activities involves fitting obstruction lights to obstacles such as chimneys and buildings in the immediate vicinity of the heliport.

Cushioned Flight

BRIEF details on the prototype of a new vertical-lift hoverplane operating on a modified form of VTOL ducted-fan lift were given last week by the National Research Development Corporation, which has placed a contract with Saunders-Roe to undertake the research, design and development of such a craft.

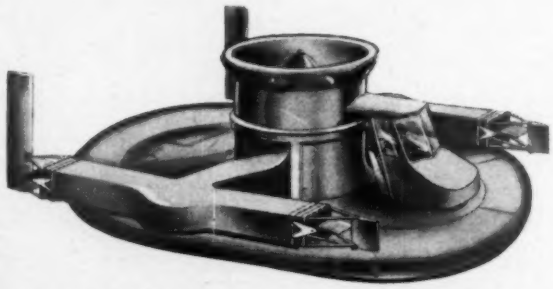
The hoverplane operating principle, invented by Mr. C. S. Cockerell, who started work on the project in 1953, involves the provision of an annulus of air under the saucer-shaped craft which encloses a "cushion" of air on which it is sustained. Designed for operation above the surface of the sea, it appears that it would hover at a height of 1-2 ft. in its present form, which is stated to be only a means of proving the principle. Tests with models have shown that it is feasible to build a full-size craft and that, by bleeding off some of the air to suitable nozzles, it could be propelled and controlled horizontally.

One would expect that a single vertical "ring" jet would not prove very stable, particularly when the craft tilts, and a way to overcome this unstable condition would be to direct the jet inwards slightly towards the centre (i.e., a tapered ring). A second, outside annulus of air would again improve its overall efficiency, so that the inner ring could help stabilization and the outer one could act as a more positive seal for the air cushion.

The first hoverplane under construction by Saunders-Roe has been designated the S-R.N.1. It is 30 ft. long and 24 ft. wide, and is powered by a standard Alvis Leonides helicopter-type powerplant having a sea-level continuous-power rating of 450 b.h.p., which drives a ducted fan to provide the supply of air for both lift and propulsion. It has a crew of two and will be "flown" by Mr. Peter Lamb, Saunders-Roe test pilot. The craft's all-up weight is estimated at 2-3 tons.

There are fore and aft ducts on each side of the main lift fan into which air is bled to provide forward propulsion thrust and control forces. Rudder- and elevator-type hinged control surfaces are at each end of these ducts and presumably can be operated differentially to give control about all three axes.

The S-R.N1 is nearing completion at Cowes and its first tethered trials are expected to take place in June. These will be followed by free trials on the Solent.



The experimental hoverplane being built by Saunders-Roe, Ltd., for Hovercraft Development, Ltd., a subsidiary of the National Research Development Corporation.

first mentioned in THE AEROPLANE of May 30, 1958, may be a cross-channel passenger and vehicle ferry, but the first operational craft likely to be built will probably weigh less than 100 tons. The efficiency of the hovercraft, however, increases with its size, and experiments which have been undertaken in the Isle of Wight show that in the future craft weighing thousands of tons and travelling at speeds of about 100 knots are possible.

One important feature of the hovercraft is that it can be loaded and serviced on land, making harbours and expensive port facilities unnecessary. This means that it could operate in many parts of the World at present inaccessible to modern transport.

Four hand-carved wooden fan blades, designed and built by The Airscrew Co. and Jicwood, Ltd., will provide the lifting thrust. These are constructed from laminations of Aerograde mahogany, glued with synthetic resin and covered with plastic. The blades' leading edges are protected by a metal sheath. There are also pre-rotational vanes built into a rigid central blanking which carries the nose fairing.

Mr. Cockerell has worked with W. H. Allen and Sons, of Bedford, and subsequently undertook radio research work at Cambridge University. Before the War he joined Marconi's Wireless Telegraph Co., Ltd., where he was responsible for the development of airborne communications equipment and for a device used for plotting enemy radar stations.

Left, the B-58 Hustler with its appurtenances in a near sonic fly-past at Las Vegas.

Below, Vulcans of No. 617 Squadron, R.A.F., led by AVM G. A. Walker doing a slow fly-past watched by the privileged spectators at Indian Springs.

R.A.F. at Las Vegas and Vandenberg

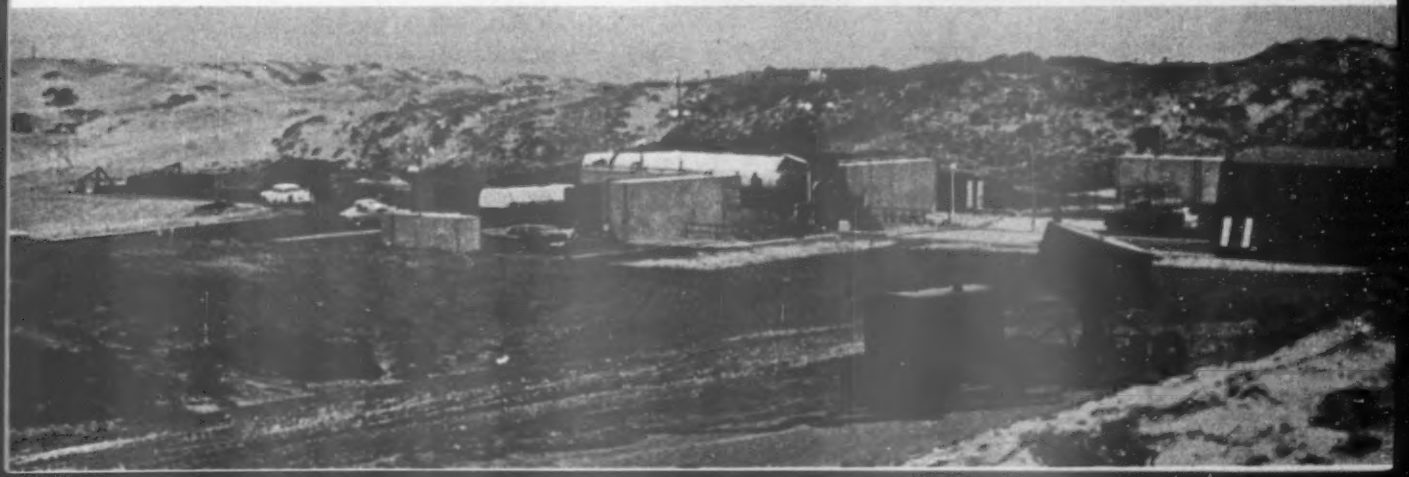
Thanks to the Air Ministry, Charles Sims, our chief photographer, was able to accompany the R.A.F. Vulcan team to Las Vegas. Four of these photographs are from a forthcoming illustrated account of the trip.

Photographs copyright "The Aeroplane and Astronautics"

AT VANDENBERG FOR THE THOR LAUNCH.—Above, AVM W. C. Sheen, Commander R.A.F. Staff Mission B.J.S.M. with Col. William S. Rader, Dep. Commander 1st Missile Div. USAF, and AVM G. A. Walker with Col. Charles Allen, Base Commander. In the background Gp. Capt. E. S. McMillan with Col. H. S. Rasmussen, Chief of Staff, all at Vandenberg for the Thor launch.

Below, the scene at the Vandenberg site of the R.A.F. Thor just prior to its firing.

Below, Nationalist Chinese F-86Fs at the start of their aerobatic display at the main flying demonstration of the World Congress of Flight.



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Tokyo Set-Back

A U.S. Civil Aeronautics Board examiner recommended on February 17 the rejection of B.O.A.C.'s application for a permit to operate through Tokyo. The examiner's recommendation, which was completely unexpected, is subject to final review by the five-man Civil Aeronautics Board. B.O.A.C. also has the right to appeal to the Board against the recommendation.

The examiner's recommendation was in three parts:—

(1) That public-interest considerations required denial of that part of the B.O.A.C. proposal to include Tokyo on its routes under the 1946 bilateral agreement.

(2) That the public interest required amendment of B.O.A.C.'s foreign permit to authorize it to operate between London and Hong Kong by way of New York, San Francisco, Honolulu and Wake Island.

(3) That a new foreign air carrier permit should be issued to B.O.A.C. authorizing it to operate between Hong Kong and San Francisco by way of Wake Island and Honolulu.

Trooping Contracts

THE announcement last week that Hunting-Clan Air Transport has been awarded a contract for air trooping to the Far East goes some way towards settling the recent uncertainty over the future of air trooping generally. It seems that, for the time being, at any rate, no radical changes are to be made to the system whereby contracts are put out to tender among the major independent operators. We understand the Hunting-Clan contract is for at least three years.

Uncertainty over the future of Hunting-Clan's two Britannia 317s is now resolved also, as these aircraft are to be used for the flights to Singapore and Hong Kong. Fitted with 114 rearward-facing seats, they will take about 24 hours for the journey to Singapore, with no overnight stops and only three refuelling stops—at Istanbul, Karachi and Bombay. This compares with about 3½ days taken by the Hermes of Airwork and Skyways, who have shared the contract which is about to expire. The flights will begin on May 15 and there will be about six flights a month.

All air trooping for the forces will in future be in modern types of aircraft. Those used at present, in addition to the Britannia, are the Douglas DC-6C and the Viscount. Since 1957 it has been Government policy to favour modern aircraft, and if possible turboprop types, in awarding trooping contracts.

When the Airwork and Skyways flights to the Far East end next month, only two independents besides Hunting-Clan will have trooping contracts—Transair and Eagle Aviation. Transair, using Viscounts, has the West-Med contract for flights to Gibraltar, Malta, Idris and Benina; this contract expires in October and tenders for its renewal are already out. Eagle, using DC-6Cs, has the contracts for trooping to Aden, East Africa and Cyprus and the local Med-Air contract. All expire soon. In addition, there are occasional trooping flights on an *ad hoc* basis, such as those by Air Charter Britannia to Christmas Island; and the Skyways freight service to Cyprus.

The three Britannia 252s which were purchased by the M.o.S., with the idea that they could be leased to the independents for trooping and other duties, have now been sold to the Air Ministry. The first was formally handed over to the R.A.F. at Lyneham on March 21 and, with the other two, will be absorbed into Transport Command as additions to the fleet of 20 Britannia 253s on order.

Investigations and Inquiries

IN the House of Commons on April 16 SIR LIONEL HEALD (Cons., Chertsey) returned to the battle for pilots' rights. On March 25 (see THE AEROPLANE of April 3, p. 396) he had asked the Minister of Transport and Civil Aviation why—having regard to the right of the pilot to defend himself and to the considerations of public safety and confidence which were involved—a public inquiry had not been ordered into the Viscount accident at Prestwick.

He pointed out that the Chief Inspector of Accidents had, in breach of Regulation 7(5) of the Civil Aviation (Investigation of Accidents) Regulations, 1951, ignored three successive written requests from the captain of this aircraft that he should be fully heard and be allowed to cross-examine witnesses before the investigation report was completed. The captain had asked that a public inquiry should be held because of the "considerations of public safety and confidence" which arose "from the use of a type of altimeter . . . now being modified."

When Sir Lionel raised the matter again in the House he alluded to the case as a striking example of the need for constant vigilance in the struggle for the protection of the individual against the arbitrary powers of the State. He said that the captain involved in the accident had received on Saturday, March 21, a copy of the chief inspector's report, which severely censured him and which he had not previously seen, and was told that it would be published on March 25.

MR. HAROLD WATKINSON, in his reply, said that the regulations had been fully and completely satisfied. After a 2½-hour interview on November 4 with the chief inspector, during which the captain had had his rights explained to him, he, the captain, had said in a letter to the Ministry, that he did not dispute the fact that some degree of responsibility could be attributed to him.

That was one reason why he, the Minister, had finally decided not to hold a public inquiry, though the initial decision on this had been made on May 9 after the first interview with the captain. A letter had been sent to the captain, setting out his rights, and he attended the Ministry and exercised them fully; he did not ask to call witnesses or further exercise his rights. In view of the circumstances he, the Minister, had not thought there was any cause to withdraw or cancel the captain's licence.

Mr. Watkinson agreed with Sir Lionel that this was a case in which the captain might have misunderstood his position. Very shortly he would be bringing to the House a clarification of the regulations and meanwhile he would re-examine the whole matter. Significantly, perhaps, neither Sir Lionel nor Mr. Watkinson alluded directly on April 16 to the question of altimeter presentation.

Forgetting the legal rights and wrongs of this case and the curious ways in which these have had to be aired, there is little doubt that the general feeling amongst pilots is that both the private Ministry investigation and the full-blown public inquiry techniques leave much to be desired in terms of method and result.

The first type of inquiry inevitably offers too little scope for question and counter-question: it is too secret; and it is

(*Continued on page 495*)

PEKING AIRPORT.—A new airport has been built in the eastern outskirts of Peking for use of Chinese domestic and international services. An Il-14 is seen here in front of the terminal building, which has a floor area of about 120,000 sq. ft.

The facts and figures give me confidence in the VISCOUNT

Continental Airlines' results exceeded expectations

These are the figures after six months' operation

Average fleet for period: 5.6 aircraft

Total revenue	$ 2,599,962
Direct expenses	$ 1,126,817
Indirect expenses	$ 954,188
Net operating income	$ 518,957
Income per mile	31.16 cents
Average load factor	47.17%
Break-even load factor	37.3% (twenty passengers)
Percentage indirect/ direct costs	84.68
Revenue passenger miles	40,845,739
Yield per revenue passenger-mile	6.08 cents

In May last year, Continental became the first airline to operate the Viscount 810 on the American continent. According to President Robert F. Six, performance, passenger appeal and economics of the new aircraft exceeded the expectations of the company. In the first three months 1,200,000 plane miles were logged, and seat mile costs were .30 cents below estimate. Although bigger and faster than earlier Viscounts, air mile costs of the 810 are no higher.

Latest improvements in performance enable Viscount 810 to offer even greater performance for operators

- ★ Take-off weight now 72,500 lb (up 3,500 lb)
- ★ Landing weight, zero fuel weight and payload all increased by 2,000 lb
- ★ Maximum payload range increased to 1200 miles
- ★ Cruising speed 365 m.p.h. When re-engined with more powerful Darts, 400 m.p.h.
- ★ Backed by Vickers/Rolls-Royce jet-prop experience of over 350 Viscounts in service with 39 airlines
- ★ Viscount 810/840 already ordered by Continental Airlines, Lufthansa, South African Airways, Ansett-A.N.A., Airwork, Cubana, Hunting-Clan, Pakistan International Airlines, T.A.A. and V.A.S.P.

VICKERS VISCOUNT 810/840

FOUR ROLLS-ROYCE DART JET-PROP ENGINES

• *Fastest and most economical medium-sized airliner in the world*

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY ENGLAND

TGA AT611/A

C

WHICHEVER END THEY PUT IT

Whether it's at one end, as in the quietly efficient Westland Wessex . . . whether it's at both ends, as in the outstanding Bristol 192 . . . whether it's upright, horizontal or in any position in between, the Napier Gazelle free turbine engine will always satisfy the exacting demands of helicopter operation. Designed specifically for helicopter application, the Napier Gazelle, with its "any angle" installation, relieves the designer of many accepted limitations and gives him more opportunity to make proper use of fuselage space.

NAPIER GAZELLE FREE TURBINE ENGINE

D. NAPIER & SON LIMITED, LONDON, W.3. A MEMBER OF THE ENGLISH ELECTRIC AVIATION GROUP

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(*Continued from page 494*)

dependent for final arbitration on too few opinions. The second method, besides being appallingly expensive in money and time, is liable to be unsatisfactory because too many people may be involved; because it is, technical assessors notwithstanding, managed by legal specialists who may not, with the best will in the world and helped by model witnesses, grasp the real significance of all the evidence; and because the witnesses, knowing that their words may be reported (or misreported) and being a little afraid of their professional interlocutors, are liable to be inhibited. Nevertheless, thanks to clear legal minds and to the expert knowledge of assessors the reports of public inquiries usually offer little cause for criticism.

What is wanted is an accident inquiry system which has all the virtues and none of the defects of either method. Such a system should not be difficult to devise. The defects and the virtues of each of the present methods are obvious to all of those who have been involved in such affairs. A small (very small) committee, consisting of a specialist investigator, a pilot, appropriate technicians and a legal representative, should be able to produce, quickly and without too much difficulty, a workable, economical and just formula.—H.A.T.

The Super Hercules Freighter

A PAYLOAD of 78,000 lb. and a direct operating cost of less than 4 cents/ton-mile are claimed by Lockheed for their newly announced Super Hercules project. Developed from the C-130B Hercules in production for the U.S.A.F., the Super Hercules is offered for civil or military freighting. No date has been given for availability, but Lockheed state that development time would be short as a large percentage of C-130B tooling can be used.

The Super Hercules would be powered by four Allison 550-B1 (T-61) turboprops and would have a 23 ft. 4 in. longer fuselage and 12 ft. 5 in. wing extension. Overall appearance of the Super Hercules would be similar to that of the C-130B, with the same rear-loading provision at truck-bed level. Airline-type accommodation could be provided in the 7,026-cu.-ft. hold for 104 passengers; maximum troop capacity would be 152. The gross weight has risen to 204,170 lb., which is also given as the max. landing weight. The brief specification which follows is based on the military proposal.

DIMENSIONS.—Span 145 ft.; length, 121 ft.; height, 38 ft.; wing area, 2,041 sq. ft.; max. hold length (excluding ramp) 65 ft.; max. internal width, 10 ft.; max. internal height, 9 ft.; usable cargo space, 7,026 cu. ft.

WEIGHTS.—Max. take-off, 204,170 lb.; max. landing, 204,170 lb.; max. payload, 78,000 lb.

PERFORMANCE.—High cruise speed, 360 knots; long-range cruise speed, 315 knots; take-off to 50 ft., max. weight, I.S.A. at s.l., 5,100 ft.; landing distance from 50 ft., at 187,135 lb., I.S.A. at s.l., full reverse propellers, 3,840 ft.; range with max. payload, 1,365 naut. miles; range with max. fuel (8,523 Imp. gal.), 3,875 naut. miles with 45,970 lb. payload; range with pylon tanks, 4,775 naut. miles with 32,000 lb. payload.

New Altimeter Concept

THE current exaggerated interest in altimeter presentations and operating methods gives importance to demonstrations, in the U.S.A. earlier this month, of an instrument using an electrically driven tape presentation. Work on this altimeter has been going on for some time by the Bulova Research and Development Laboratories, Woodside, New York, and the U.S.A.F. has now ordered 25 instruments for bench-testing and flight evaluation.

By use of a tape (there are 40 feet of it) very accurate readings are possible and the 10 ft. height graduations at sea level are separated by as much as two-tenths of an inch as the tape is driven past the large indicator window by servo motor. The three sensing elements are aneroid capsules, but their extension is measured by a magnetic detector the output of which is amplified to control the tape-driving motor. Bulova claim very high levels of operating accuracy for the instrument—±20 ft. at 20,000 ft., for instance.

There appears to be one major possible disadvantage and two minor disadvantages in this type of altimeter. The minor faults are that the standard casing is rather long (8½ in.) and that an electrical failure would cause the instrument to be inoperative; this difficulty could be overcome by the use of a normally operated stand-by instrument. The more serious possible fault, in the present form of the presentation, would appear to be the likelihood that, even at small rates of ascent or descent, the tape might be moving so comparatively quickly past the window that the figures would be difficult to read. The use of a secondary, coarse, tape-scale would remove this difficulty.

HIGH DENSITY.—Some B.E.A. Viscount 701s are now in service with accommodation increased from 47 to 58 or 63. The conversion includes the addition of built-in air stairs, two extra windows and location of two toilets adjoining the front bulkhead. These aircraft are being employed on internal services in Germany and will be introduced on the routes from Gatwick to Cologne—Hanover, Jersey and Dinard.

The Pilots Speak

AT the Helsinki conference of the International Federation of Air Line Pilots' Associations it was recommended that the previous year's resolution on crew complement should be confirmed without amendment.

This bare statement seems to set the seal of airline pilots' approval on a decision which may considerably affect some operators' flight-deck crew policies in the future. In brief, the resolution passed at the IFALPA Bogotá conference was that there should be a minimum of three flight-crew members on all turbojet transports, and on all turboprop transports with a maximum weight of more than 80,000 lb. The resolution added that it was considered desirable that all three crew members should be qualified as pilots.

In fact, the thinking which lies at the back of this resolution is by no means so revolutionary as it appeared to be a year or two ago. Since the big turbojet transports appeared, airline operators have been moving steadily towards the view that a practical flight-deck complement must include a third pilot—though not necessarily one who is fully qualified on the particular aircraft type. Apart from the need to have a team which is "fail-safe" in the event of sickness or other incapacitation in an aircraft which cannot be handled by one pilot alone, a third pilot (whatever his other qualifications) is essential on long-haul flights with advanced types of aircraft if the captain and first officer are not to find themselves uncomfortably forced to stay in their seats for six or more hours at a stretch. Incidentally, Mr. E. R. Quesada, the U.S. Federal Aviation Agency administrator, issued what amounted to a directive recently which said, in effect, that pilots must not leave the flight deck.

In a statement to member associations, approved at the Helsinki conference, IFALPA made an excellent case for a revision of thinking about flight-deck policy—and one that was all the more excellent because it made a case, also, for the retention and use of the specialist experience possessed by other crew members. The statement explained in great detail how the balance of control-cabin work-load had changed in recent years; how the need for specialist skills had been reduced; and how the functions of other crew members had been, in part or in whole, transferred to the pilots.

More important, in the new situation, is the need for a third crew member who can offer quick, co-operative effort and can anticipate from experience the demands of the captain for navigational services, for the interpretation of ATC and meteorological messages and for assistance in the maintenance of an essential visual watch. Such work can only be done effectively by a crew member who has basically the same background of training and experience.

Obviously there will be, for many years to come, aircraft types and circumstances which demand the services of specialists on the flight deck, but the expansion of VHF and HF R/T facilities and the duplication of equipment has largely

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removed the need for a radio operator except where language problems are acute; navigation is becoming very much a directly pilot-controlled and interpreted function; and the introduction of turbines and of system automaticity is tending to reduce the responsibilities of the engineer.

Another important resolution confirmed at Helsinki was that there should be internationally agreed regulations about maximum flight and duty times and minimum rest periods. The majority of countries and/or operators have their own regulations in these matters and IFALPA's pressure is directed primarily at the need to regularize basic rules, preferably through ICAO, so that safe standards can be guaranteed for the protection of crews and passengers on all civil transport operations everywhere. The Federation is producing a detailed statement of requirements for such regulations.

Dealing with aircraft performance—and particularly in relation to turbojet transports—the conference considered that take-off safety factors should be increased and that the margins should be acceptable only on a trial basis and provided that the aircraft is fitted with monitoring instrumentation. Meanwhile it was recommended that, during the initial operations of turbine-powered aircraft, all pilots should participate in an evaluation of the performance in relation to the codes to which the aircraft have been certificated. Member associations are encouraged to press for the development of adequate take-off monitoring devices.

Among other important recommendations and resolutions, the conference resolved that the VMC minima must be raised to a flight visibility of at least 8 km. (5 miles), with a similar horizontal distance and a vertical distance of 600 m. (2,000 ft.) from cloud.

Eland-Convair Performance

FLIGHT manual figures for the Eland-Convair 340 show small improvements in most respects over the earlier brochure figures. Most significant are the increases in maximum take-off weight possible at temperatures and altitudes above sea level I.S.A.; these increases range between 1,800 and 2,000 lb. Similarly, increases of 1,550 lb. to 1,900 lb. are authorized for the maximum landing weight. Reductions of between 100 ft. and 575 ft. have been made in take-off and landing field lengths.

Newest data for the Eland-Convair follow, with comparative figures for the standard 340 with Pratt & Whitney R-2800-CB17 engines in brackets. Performance figures for the Canadair 540 should not differ in any important respect. On the first of three extensive sales tours, a Canadair 540 was demonstrated to Allegheny Airlines last month, and prospects of selling to this airline appear to be good. Decision to use turboprop Convairs has already been made, but the final selection between Elands and Allison 501 engines has not.

WEIGHTS.—Max. take-off, 53,200 lb. (49,100 lb.); max. landing, 50,670 lb. (47,650 lb.); max. zero fuel, 47,000 lb. (47,000 lb.); max. payload, 13,668 lb. (13,535 lb.); operating weight empty, 33,332 lb. (33,465 lb.); manufacturing weight empty, 31,734 lb. (31,289 lb.); max. fuel capacity, 1,692 Imp. gallons (1,440 Imp. gallons).

PERFORMANCE.—F.A.A. take-off field length, 4,700 ft. (5,000 ft.); time to 10,000 ft., 6.5 min. (14 min.); time to 20,000 ft., 15.6 min. (35 min.); cruising speed, 275 knots (220 knots); single engine ceiling, 9,500 ft. at 50,000 lb. (9,500 ft. at 45,000 lb.); F.A.A. landing field length, 4,350 ft. (4,000 ft.); range with max. payload (½-hr. fuel reserve), 600 naut. miles (215 naut. miles); range with max. fuel, 1,515 naut. miles (1,890 naut. miles) with 6,398 lb. (5,345 lb.) payload.

South American Commentary

March—Stale, Flat and Unprofitable

MARCH went by on this embattled continent with no more than rancorous glances being cast at each other by the leading airlines on either side of the IATA fence. A new factor is to be introduced when Aerolíneas Argentinas' Comet 4s begin winging their way from Buenos Aires to London and New York with a full list of operational stopovers. B.O.A.C., too, will fly Comets on the South American run, but significantly, B.O.A.C. and A.A. concluded recently what virtually amounted to a non-agression pact on services between B.A. and capital cities of Europe.

Stateside, A.A. will have to buck Pan Am's big Boeing 707s, but "when?" is the question. Furthermore, in order to operate a commercially feasible route, Pan Am will have to fight its way through a mountain of red tape and bilateral agreements which, we are sure, will not be easily trodden underfoot or swept out of the way. It is arguable that the Argentine Government will hint heavily that it wants A.A.'s interests protected as much as possible. Pan Am recently paid a call on President Frondizi in Buenos Aires and said that they, too, had jet-propelled aeroplanes and hoped to fly them to Buenos Aires as soon as possible—which brings us back to where we started: how soon is possible?

In Brazil, the jet age seems split on a swords-before-ploughshares issue, because the Brazilians are looking around for fighter aircraft, but the money does not seem available for credits for the Brazilian airlines to speed their jet re-equipment. The Brazilian Government are meanwhile busy separating the contenders in a massive catfight that has developed over internal services in Brazil.

Río de Janeiro, meanwhile, hit aeronautical headlines again a couple of weeks ago when the arrival there of Rolls-Royce's W. Hill reminded everyone of the big jet engine maintenance plant which R-R are to build near Brazil's capital city—much to the disgust of Argentinians who wanted it in Buenos Aires. However, Río is a more logical place because B.A. is, practically speaking, the southernmost tip of this continent and many services don't reach that far. However, with the increasing importance of Bariloche as an all-year-round tourist centre, B.A. may in time lose its End of the World distinction and become just another stopover for many flights.

The Uruguayans are having a big row in a small country. They always managed their internal aviation affairs very well until they decided that the wise thing to do was form a Civil Aeronautics Board with an Examination Tribunal to yea or nay on applications for new airline franchises. Ever since then the acrimony has been visible for miles on a clear day, especially since a new organization called Interocean Airways has applied for South American-Europe services, using chartered DC-7 aircraft. Established airlines, notably the Uruguayan Government's PLUNA, hinted darkly that there were any amount of niggers in Interocean's woodpile, which the latter refuted in no uncertain terms. PLUNA contended that Interocean had failed to stick to Uruguayan laws in the formation of the appropriate company: Interocean said that they had not failed to do so, and there, for the moment, the matter rests.

Meanwhile in Argentina the two already-delivered Mark 4 Comets are being industriously flown back and forth in preparation for scheduled services which are to start once No. 3 aircraft has been delivered to Aerolíneas Argentinas, proud purchaser of six Comets. Aerolíneas say that they can pay for and write off the Comets in five years even assuming that the aircraft operate at only 50% seat-load factors, a figure which should be exceeded, although possibly not by very much. Whether jets will succeed or fail in South America is, of course, a matter on which only time will venture an opinion, but as has been pointed out before in this column (THE AEROPLANE, January 23, p. 95) a large volume of traffic will always fall to the airline which gives you the farthest for the leastest.

In Central America, an organization named SALA is currently engaged in battling a cold war front set up by rival organizations in the United States. What SALA (Servicios Aerotécnicos Latino Americano S.A.) does for a living is to recondition and convert aircraft, particularly C-46 Commandos which they turn into passenger aircraft. SALA operate in Costa Rica, a proceeding which hardly seems logical until one realizes that wages in Costa Rica are far lower than those paid in the U.S., and thus SALA can offer cut-rate repair and maintenance services without the lower intake affecting the quality of their services rendered. Unfortunately, say SALA, some shops located in the Solid South have been waging a rumour campaign against them.

Going back to the age-old "what's the mattah with IATA" problem, the question now is "what next?" At the moment the answer seems to be "nothing next." No immediate prospects are in sight for a new *rapprochement* between affiliated and non-U airlines. The big lines waved a threatening big stick over the "freebooters" two months ago, offering to start an all-out price war if the little fellers didn't do something about their fares, but both big and little lines are so busy fighting each other that they really haven't the time to carry on IATA-wide arguments. Besides, this is summer-time in South America and it's too hot to fight over trifles.

FEDERICO KIRBUS.

AS A FULLY-INTEGRATED WEAPON...

Everything connected with the flying and the operating of the ENGLISH ELECTRIC Lightning was designed and developed as a co-ordinated system. The airframe, the engines, the radar equipment, the electronic aids, the armament, the fire control devices—all were planned from the start to make the Lightning safe for its pilot, and deadly for its target.

...THE LIGHTNING

IS INCOMPARABLE

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SEASLUG

SHIP-TO-AIR MISSILE WITH A SHARPSHOOTING RECORD

The Seaslug is the Royal Navy's first ship-to-air missile. Launched from the pitching, tossing deck of its trial ship, H.M.S. Girdle Ness, it has proved its accuracy under the most trying conditions. Although the Seaslug does not need to score a hit to destroy its target, the test vehicle, without a warhead, has made direct strikes frequently on target aircraft. With long range radar, it can engage bombers up to the maximum height at which modern aircraft can fly. The firing crew is far smaller than the crew of a gun turret in a major warship.

Powered by a solid fuel sustainer motor and four boosts, the Seaslug has been designed and constructed by AWA in conjunction with the Sperry Gyroscope Co. Ltd., and G.E.C. Ltd.

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD., Baginton, Coventry, England

MEMBER OF HAWKER SIDDELEY AVIATION DIVISION

Flying the Meta-Sokol

by John Fricker

A CRUISING speed of nearly 130 m.p.h. on 140 b.h.p. total power, a fuel consumption of 28 a.m.p.g. or more, and the ability at the same time to carry four persons and light baggage: these are figures remarkable enough to invite further investigation of a design offering them in combination.

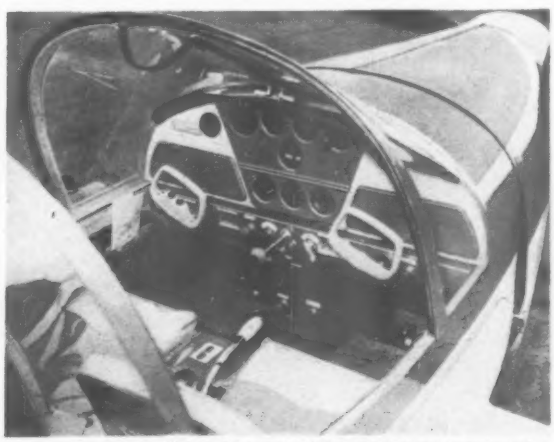
Both exploration and confirmation became possible last week with the arrival from Czechoslovakia of OK-NMB, the first L-40 Meta-Sokol to reach the U.K. The machine has been bought, via R. K. Dundas, and Gp. Capt. E. L. Mole as U.K. agent, by Mr. B. C. Ecclestone, the motor-racing enthusiast, who will use it to follow his team of Connaught cars around the competition circuits. Through his courtesy the Meta-Sokol was made available to us for some extensive handling, prior to its C. of A. validation trials with the A.R.B.

As its name suggests, the L-40 is an all-metal development of the earlier M.1C Sokol three-seat wooden touring monoplane, produced in quantity soon after the War. In its original form the L-40 retained the 105-b.h.p. Walter Minor 4-III engine and seating layout of the Sokol, but the fuselage and tail contours were extensively modified for additional capacity and performance. A tricycle undercarriage was also required, but as the existing arrangement of the rearward-retracting mainwheel legs did not lend itself to convenient conversion, recourse was made to the unusual reversed tricycle configuration.

This was achieved by moving the tailwheel well forward to the mid-fuselage point, and extending the oleo leg until an almost level ground attitude was attained. Most of the advantages of a nosewheel undercarriage are obtained with this layout, which, from the pilot's viewpoint, is almost indistinguishable from the conventional arrangement. As in the M.1C, the mainwheels remain more than half-exposed from their stowage, and offer considerable protection in a belly landing.

Relatively few three-seat versions of the Meta-Sokol were built, for development flying and service with the Czech aero clubs, and for export sales a full four-seater was produced. This coincided with the development of the Walter Minor engine for the necessary additional power, which was achieved by converting it to fuel injection and adding a centrifugal supercharger. The latter is, perhaps, the most remarkable feature of the resultant M-332-SC engine, which with its aid develops 140 b.h.p. at 2,750 r.p.m. for take-off, or with the supercharger declutched, 115 b.h.p. at similar r.p.m.

The supercharger, which is mounted behind the engine, with an intake pipe extending forward to the rear of the airscrew disc, increases the manifold pressure by 0.2 of an atmosphere at sea level, where it may be used at full throttle for up to 5 min. From 5,000 ft. and above it may be used as required. Performance is also assisted by the variable-pitch, but not constant-speed, V410 two-bladed 6 ft. 3 in. metal airscrew.



Photographs copyright "The Aeroplane and Astronautics"

The cockpit of the Meta-Sokol is well laid out, with comprehensive basic equipment, and ample room for additional radio and instruments. The standard of finish is also quite high. On the port wheel are the airscrew pitch buttons.

Pitch is controlled electrically via a unique press-button system on the port control wheel. A button marked with a plus sign moves the blades into fine pitch, while the minus button coarsens them off and, although there is no direct indication of blade angle, the ammeter gives some indication that the system is operating. In practice I found the push-buttons quite convenient, if rather sensitive, to use, a quick "blip" sufficing to alter the engine speed by 200-300 r.p.m.

The cockpit is otherwise conventional, with full dual control, except for toe-brake pedals on the left-hand side only, and a central throttle plunger. Spring bias on the throttle resulted in a slightly disconcerting increase of power when taxi-ing unless the concentric friction nut was screwed fairly tight, which naturally complicated engine handling. Grouped round the lever are the ignition, mixture and tank selector levers; fuel is in a 12-gal. tank, with integral gauges, in each wing root.

Although OK-NMB had only basic flight and engine instruments, there is ample room for additional equipment, including radio, on the large front panel, which has spacious enclosed lockers flanking the central dash. Full instrument illumination, navigation and landing lights for night flying, and a heated pitot head, are also fitted.

Between the two front seats, which offer a reasonable amount of room for an aircraft of this size, are the large chromium-plated levers for the manually operated flaps and undercarriage. The flaps extend to either 20° or 33°, with the usual push-button release, while the undercarriage has a selector and coloured indicator on the lever quadrant, and requires familiarization for its easy operation.

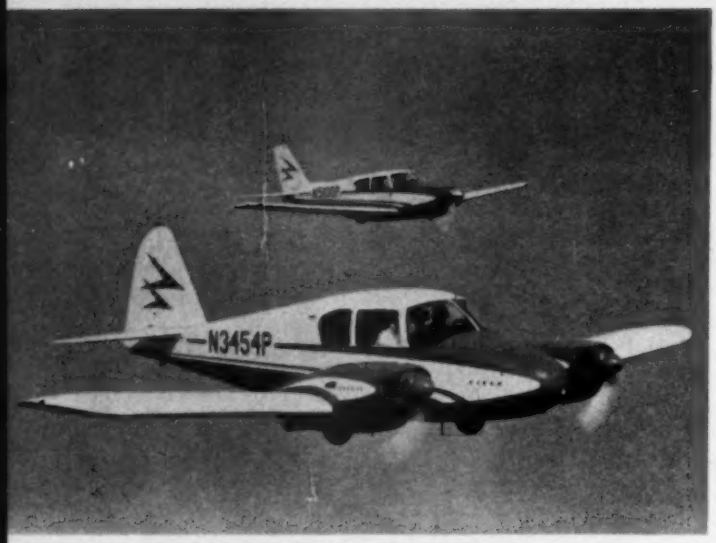
For either retraction or extension the handle on the lever must first be depressed to disengage the locks, indicated by a change in the colour shown alongside, and then rotated firmly through 180° in a continuous sweep to its required position. One's weight must then be leaned on the lever to engage the locks, and get either a red or green indication.

Next to the undercarriage lever is the trim wheel and indicator strip for the adjustable tailplane. The trim wheel is high-geared, slightly stiff and rather difficult to grip, but does not come in for much use in flight. It is set a little tail heavy before take-off, after engine starting and warm-up.

As the electric starter turns the crankshaft through the supercharger, this must be engaged by its dashboard plunger before the engine can be started, and subsequently declutched. Taxi-ing, after releasing the parking-brake catch under the port dash, is aided by tailwheel steering at extremes of rudder pedal movement, augmented when necessary by firm use of brake. Although the Meta-Sokol already has its tail up, the C.G. is sufficiently aft of the mainwheels to make nosing over through severe braking unlikely.

All-round view through the closely fitting sliding canopy was excellent, as we taxied out at Croydon, and the oleo-pneumatic undercarriage gave a pleasantly damped ride. With four persons and almost full fuel, the use of the supercharger and half-flap was indicated for take-off, and the clutch lever was therefore pulled out as part of the vital actions. Pitch was also fractionally coarsened to keep the r.p.m. within limits.

On opening up to full throttle (about 750-mm. Hg boost and 2,700 r.p.m.), a fair amount of left rudder was initially needed to keep straight, but directional control appeared ample at an early stage. At about 50 m.p.h., moderate aft movement



PIPER COMANCHE (Above, background)—U.S. four-seat tourer. 250-h.p. Lycoming O-540-A1A engine. Span, 36 ft.; weight loaded, 2,800 lb.; cruising speed, 160 m.p.h. Price, £9,030. PIPER APACHE (Foreground)—U.S. four/five seat executive aircraft. Two 160-h.p. Lycoming O-320-B engines. Span, 37 ft. 1¾ in.; weight loaded, 3,800 lb.; cruising speed, 171 m.p.h. Price, £16,580.

SAAB 91-D SAFIR (Right)—Swedish four-seater. 180-h.p. Lycoming O-360-A1A engine. Span, 34 ft. 9 in.; weight loaded, 2,657 lb.; cruising speed, 146 m.p.h. Price, £8,695.

AVIAMILANO FALCO (Above)—Italian two-seater. 150-h.p. Lycoming O-320 engine. Span, 26 ft. 2 in.; weight loaded, 1,715 lb.; cruising speed, 160 m.p.h. Price, £4,580.

Flying the Meta-Sokol . . . .

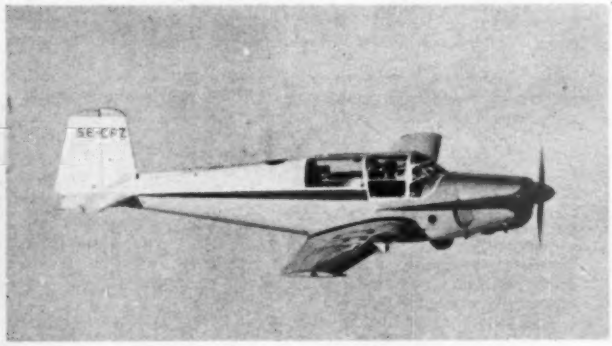
of the wheel was applied, and the Meta-Sokol unstuck soon afterwards, having used surprisingly little of the grass runway.

Taking into account my struggle with the unfamiliar undercarriage system, which delayed the climb away, a time to 3,000 ft. in 5 min. was quite reasonable for the available power. The supercharger was disengaged after raising take-off flap, to keep within low-altitude limits, and an en-route climb continued at 85 m.p.h., with full throttle and pitch coarsened to 2,400 r.p.m.

In turbulent air I found some difficulty in maintaining the trimmed climbing speed, and there was a certain amount of lateral unsteadiness in gusts, but the aircraft was not easily deflected from the desired heading. The controls were pleasantly responsive, for a moderate degree of effort, although firm application of the ailerons was needed to initiate or take off bank. The elevators appeared slightly lighter in operation, with a representative control force of about 10 lb. per *g*.

The least effort seemed to be required for rudder actuation, and directional stability was more positive than in the other two planes. Lateral control remained effective almost down to stalling speed, the slow-flying characteristics of the Meta-Sokol being very good. With half-flap, the minimum speed for level flight is about 55 m.p.h. After a further reduction, with the undercarriage extended, the stall breakaway comes, with full aft wheel movement, at about 45 m.p.h.

There is little stall warning, but the nose drops gently and straight, and if the wheel is kept hard back, the Meta-Sokol sinks evenly in a slight tail-down attitude at about 55 m.p.h., I.A.S., indicating a descent of some 1,000 ft./min. on the V.S.I. A similar thing happens in all configurations. In Czechoslovakia, the L-40 is semi-aerobatic, and Mr. Brabec, the test pilot who ferried OK-NMB to the U.K., demonstrated a smooth stall turn at 80 m.p.h., and spins in each direction.



SUF
Min

THIS WEEK'S PERSO

AUSTER WORKMASTER (Above)—British two-seat agricultural aircraft 180-h.p. Lycoming O-360-A engine. Span, 36 ft.; weight loaded, 2,550 lb. cruising speed, 91 m.p.h. Price, £4,500.

BEECH BONANZA (Left)—U.S. four-seat tourer. 250-h.p. Continenta IO-470-C engine. Span, 32 ft. 10 in.; weight loaded, 2,900 lb.; cruisin speed, 180 m.p.h. Price, £11,375.

Photograph copyright "The Aeroplane and Astronautics"

These were entered well above stalling speed at 70 m.p.h. by the application of full rudder and aft elevator. The L-40 did not flick, however, but rolled smoothly into a two-turn rapid spin, from which recovery was conventional. Total height loss was about 800 ft.

After a brief cruise around at 660-mm. Hg. and 2,300 r.p.m. (supercharger out), which fully confirmed the 127 m.p.h. low-altitude cross-country speed with four up, for a fuel consumption of 5 g.p.h., I flew the Meta-Sokol into Biggin Hill's restricted club landing area. A powered approach at about 75 m.p.h. in the very gusty conditions presented no difficulty at all, and the Meta-Sokol was simply motored on to the ground. Elevator response remained good after power had been removed, but there seemed no tendency to touch down tailwheel-first on the pleasantly soft undercarriage in a normal tail-down "tricycle" arrival. In calmer conditions, a power-off approach at 70 m.p.h. should be sufficient, and the landing run kept to a very low figure by liberal braking.

With its comprehensive equipment, attractive specification and excellent performance, the Meta-Sokol appears to be an extremely worth-while proposition at a U.K. delivery price, duty-paid, of £4,400. The export programme of the supercharged L-40 started in October last year, and examples have already been sold to Denmark, Holland, Pakistan, S. America and Switzerland, in addition to the first arrival in Britain.

Leading Particulars

DIMENSIONS.—Span, 33 ft. 9½ in.; length, 24 ft. 9½ in.; height, 8 ft. 1 in.; wing area, 156 sq. ft.

WEIGHTS.—Empty, 1,177 lb.; pilot and three passengers, 681 lb.; oil (1.7 gal.), 16 lb.; baggage, 11 lb.; useful load, 882 lb.; gross, 2,059 lb.

PERFORMANCE.—Max. sea-level speed, with supercharger (5 min.), 147 m.p.h.; unsupercharged, 140 m.p.h.; cruising speed, 126.7 m.p.h.; max. initial climb, 885 ft./min.; unsupercharged, 630 ft./min.; absolute ceiling, 17,000 ft.; unsupercharged, 12,628 ft.; take-off distance to 50 ft., 1,312 ft.; landing distance, from 50 ft., 1,722 ft.; landing speed, with flap, 59 m.p.h.; range, 686.5 miles.

AERO 45 (Below)—Czechoslovak four-seat tourer. Two 105-h.p. Walter -III engines. Span, 40 ft. 2½ in.; weight loaded, 3,306 lb.; cruising speed, 146 m.p.h. Price, £10,750.

Photograph copyright "The Aeroplane and Astronautics"

AL AIRCRAFT SHOW

A second Sales Weekend is being organized by W. S. Shackleton, Ltd., at Kidlington Aerodrome, Oxford, from today until Sunday. On these pages are illustrated some of the aircraft which will be there; the prices quoted by the organizers are for standard aircraft without radio or de-luxe fittings, and include U.K. delivery charges and import duty.

Other types to be presented include the Jackaroo, Tiger Moths rebuilt by Rollason Aircraft and Engines, Ltd., and that company's Jodel and Turbulent; Garland-Bianchi Linnet; D.H. Dove and Heron; Piper Tri-Pacer and Super Cub; Beech Super 18; Piaggio P.136, and Aviation Traders Prentice six-seater.

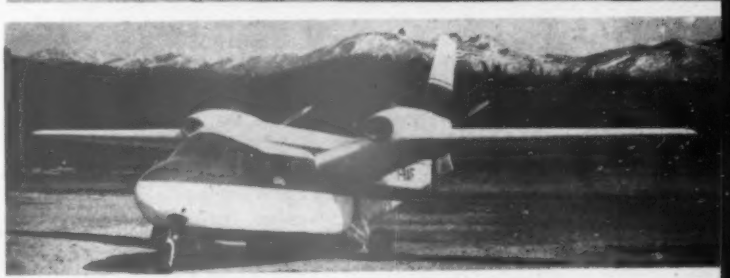
Photograph copyright "The Aeroplane and Astronautics"

RHEIN RW.3 MULTOPLANE (Above)—West German two-seater. 75-h.p. Porsche engine. Span, 34 ft. 2 in. or 50 ft. 6 in.; weight loaded, 1,940 lb.; cruising speed, 118 m.p.h.; Price, £3,290.

CESSNA 310 (Below)—U.S. five-seat executive aircraft. Two 260-h.p. Continental IO-470-D engines. Span, 36 ft.; weight loaded, 4,700 lb.; cruising speed, 220 m.p.h. Price, £26,380.

BEECH TRAVEL AIR (Below)—U.S. four-seat executive aircraft. Two 180-h.p. Lycoming O-360-A1A engines. Span, 37 ft. 10 in.; weight loaded, 4,000 lb.; cruising speed, 192 m.p.h. Price, £22,535.

Howard Levy photograph



PIAGGIO P.166 (Above)—Italian six/eight-seat executive aircraft. Two 340-h.p. Lycoming GO-480-B1C6 engines. Span, 46 ft. 9 in.; weight loaded, 7,716 lb.; cruising speed, 200 m.p.h. Price, £34,075.

TIPSY NIPPER (Left)—Belgian ultra-light single-seater. 40-h.p. Hepu engine. Span, 19 ft. 8 in.; weight loaded, 660 lb.; cruising speed, 100 m.p.h. Price, £585 as kit, excluding engine, etc.

The Fighting Services

Royal Flights

MEMBERS of the Royal Family are to use Transport Command Comet 2s of No. 216 Squadron for some of their longer journeys. This was announced last week by the Rt. Hon. George Ward, Secretary of State for Air, in a written Parliamentary reply to a question on any proposed alterations in arrangements for air travel by members of the Royal Family.

The 10 Comet 2s of Transport Command have now logged 18,000 flying hours and occasions might arise when these aircraft, and later the Service's Britannia C.1s, would be used for the longer Royal journeys. "H.M. The Queen has been graciously pleased to approve that, when such an occasion arises, Transport Command may have the honour of undertaking the flight."

H.M. The Queen and H.R.H. Prince Philip flew in one of the Command's Comets in June, 1957, from R.A.F. Marham to R.A.F. Leuchars and back to London Airport. Queen Elizabeth the Queen Mother and Princess Margaret were to fly from London Airport to Rome last Monday, April 20, in a No. 216 Squadron Comet 2 piloted by Sqn. Ldr. E. P. Pullan. They will return in the same aircraft on April 25 to Paris, where they are to spend the weekend.

Antarctic Flying

PLANS are well advanced in the Australian Department of Air to have a surplus Dakota modified for ski-operation by the R.A.A.F. with future Australian National Antarctic Research Expeditions (ANARE). The Department is already drawing heavily on U.S.A.F. experience with ski-Dakotas and is negotiating in the United States for a ski-type undercarriage. It is planned to send the R.A.A.F. aircraft and crew south at approximately the same time as the departure by sea of the next ANARE relief party in December.

Due to the lack of facilities for reassembling the Dakota on the Antarctic continent, however, prospects of fitting sufficient extra tankage to fly it south via New Zealand and McMurdo Sound are also being investigated. This ski-Dakota project is reported to represent a compromise between moves by the Australian Department of External Affairs, Antarctic Division, for the use of an R.A.A.F. Lockheed C-130 Hercules and the Air Force's opposition to setting one aside for this work. An account of the operations of the R.A.A.F. Antarctic Flight based at Mawson was given in THE AEROPLANE of March 7, 1958, pp. 325-7.

"At Home" Profits

THE record sum of £30,000 was subscribed by members of the public who visited R.A.F. stations Battle of Britain "At Home" day, September 20, 1958. The money has been given in equal shares to the R.A.F. Benevolent Fund and the R.A.F. Association. Nearly 1,150,000 people visited the 34 service stations which were open for this annual event.

Royal Festival

THE Royal Air Force Anniversary Concert, this year celebrating the foundation of the R.A.F. in 1918, was held on April 14 at the Royal Festival Hall, London.

This very popular and joyous occasion was touched with lustre by the sparkling presence of H.R.H. Princess Margaret.

Sir John Barbirolli with the Hallé Orchestra, and the Central Band of the R.A.F., conducted by Wg. Cdr. A. E. Sims, shared a stirring and tuneful programme. A thrilled audience gave a great ovation to Mme. Gina Bachauer, the renowned solo pianist, for her interpretation of Grieg's piano concerto in A minor. Six cornet players who played two rip-roaring little numbers were also received with delight.

The climax to the concert, as last year, was Tchaikovsky's "1812" overture. If this becomes a tradition it is an excellent one since we all went home enthusiastically vibrating.

It was good to see every seat occupied, a cause for congratulation to the organizers and gratification for the R.A.F. Benevolent Fund, to whom all proceeds are to be given.

Among those attending the concert were the Air Minister, the Rt. Hon. George Ward; Mr. Airey Neave, Under-Secretary of State for Air; Marshal of the R.A.F. Sir Dermot Boyle, Chief of the Air Staff; Viscount Knollys, chairman of the R.A.F. Benevolent Fund; the Dowager Lady Trenchard; Dr. Barnes Wallis; Air Vice-Marshal Sir John Cordingley, Controller of the R.A.F. Benevolent Fund; and four of the surviving 11 R.A.F. holders of the V.C.—H.M.L.

PREMIER AWARD.—The Boyd Trophy for 1958 was presented to No. 845 Squadron at R.N.A.S. Culdrose on April 10 for its part in the successful salvage of the Liberian tanker "Melika" in the Red Sea last September. Vice-Admiral W. T Couchman, Flag Officer Air (Home) is seen presenting the trophy to Lieut. Cdr. H.M.A. Hayes, C.O., No. 845 Squadron.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. J. W. Foster, D.F.C., A.F.C., to the Department of the C.A.S.; Sqn. Ldr. J. H. Ellis to the Department of the Air Member for Supply and Organization, with acting rank of Wg. Cdr.

Bomber Command: Wg. Cdr. D. C. Lowe, D.F.C., A.F.C., to R.A.F. Marham to command the Flying Wing.

Fighter Command: Wg. Cdr. C. C. F. Cooper, D.F.C., to R.A.F. Turnhouse to command; Wg. Cdr. D. M. Clause, A.F.C., to R.A.F. Church Fenton to command the Flying Wing; Sqn. Ldr. G. L. Pendred to R.A.F. North Coates as Wg. Cdr., Operations, with acting rank of Wg. Cdr.

Transport Command: Sqn. Ldr. F. E. Lord, A.F.C., to Headquarters, as Staff Officer to the Inspector General for Air Transport, with acting rank of Wg. Cdr.

Technical Training Command: Wg. Cdr. J. F. Sanders to R.A.F. Technical College, Henlow, for education duties.

Maintenance Command: Wg. Cdr. F. E. Frayn, M.B.E., to Headquarters, as Staff Officer, Administration, with acting rank of Gp. Capt.

R.A.F. Germany (2nd T.A.F.): Wg. Cdr. J. B. Denning to Headquarters for administrative staff duties.

Other Appointments: Wg. Cdr. H. C. Bailey to Headquarters, Allied Air Forces, Southern Europe, as Organization and Training Staff Officer; Wg. Cdr. R. S. Loveland to the M.o.S.; Wg. Cdr. G. A. Potter, O.B.E., to Headquarters 3rd Air Division, U.S.A.F., as R.A.F. Liaison Officer; Sqn. Ldr. I. L. Dunn to the Ministry of Supply, with acting rank of Wg. Cdr.

REUNIONS

R.N. Seaplane Bases, No. 269 Squadron.—The 37th all ranks reunion of the R.N. Seaplane Bases, Port Said and Alexandria, No. 269 Squadron, Old Comrades' Association will be held at the Chicken Inn Restaurant, Victoria, London, on May 2 at 18.00 hrs. Hon. sec., Mr. W. C. Shilling, Selgrove, Kewferry Drive, Northwood, Middx.

No. 46 Squadron.—In spite of recent lively correspondence in this journal contesting the claim, No. 46 Squadron stoutly maintains that its annual officers' dinner on June 6 at the Park Lane Hotel, London, will be the 42nd reunion. Sqn. Ldr. Peter Gifkins, Officers' Mess, R.A.F. Linton-on-Ouse, Yorks, will be very pleased to send the traditional dinner notice to any former members of the Squadron who are not already on his mailing list.

No. 112 Squadron.—An officers reunion dinner will be held at the White Hart Hotel, Brasted, near Sevenoaks, Kent, on May 16. Tickets, price 21s., available from Flt. Lt. R. A. Brown, R.A.F. Flying College, Manby, near Louth, Lincs.

ASTRONAUTICS and MISSILES

J. R. Cownie

Progress Report on Thor

Los Angeles, April 11

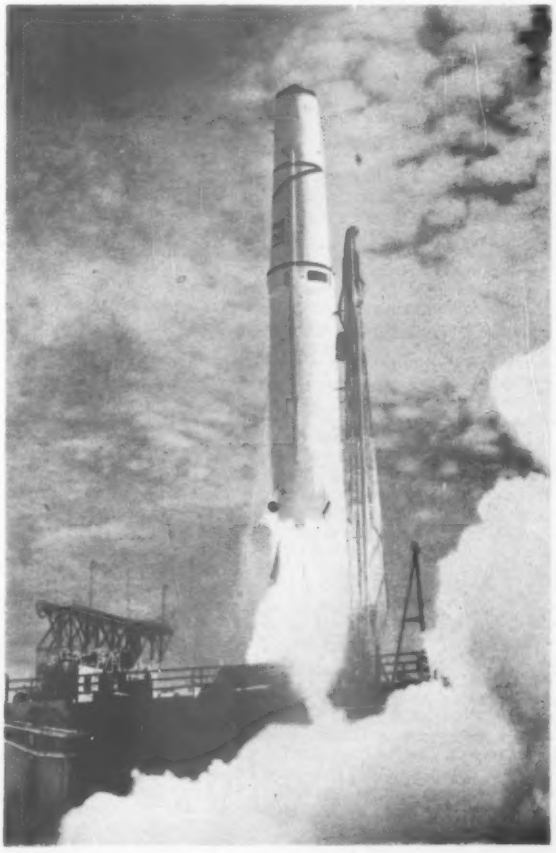
PROGRESS with the British Thor sites was recently stated by the Ballistic Missiles Division of the U.S.A.F. in California. Four squadrons of Thors are to be sited in the U.K. Each has 15 missiles, with a central receipt, inspection and maintenance building.

The missiles of each squadron will be located in five groups of three Thors each. Individual missiles in each group are several hundred yards apart, while the five groups of each squadron will be approximately 15 to 20 miles apart. This wide dispersal of each squadron's missiles should prevent them all being destroyed simultaneously in the event of an attack.

Thors are normally stored horizontally, in which case their erection time to firing is 15 minutes. In times of tension they can be kept in the vertical position; in this case only seven or eight minutes warning is needed before they can be launched.

Equipment for the third British Thor squadron is now arriving in the U.K. Each squadron has approximately 5,000 tons of equipment. By March 31, 11,534 tons of this equipment had been delivered to Britain, 69% of it by air. This is equivalent to 505 loads for C-124 aircraft.

Disguised in American uniforms and visitors' protective helmets, three members of the R.A.F. who have been on a 13-week training course with Rocketdyne (North American Aviation Inc.) are seen around a Thor power unit. (L. to R.) Chief Technician Sidney Allen (Sheffield), Junior Technician Graham R. J. Fryer (Cheam, Surrey) and Corporal Technician John G. Webb (Poole, Dorset). The gimballing arrangement for the vernier rocket can be seen.



A Thor leaves its launching pad at Cape Canaveral.

More money, effort and resources have been devoted to developing the Thor IRBM than went into the World War II Manhattan programme which produced the first atomic bomb. This is only one of many fascinating facts about Thor which have been revealed to the party of British journalists recently touring Thor establishments in the United States. The obvious sense of urgency behind the Thor programme is most impressive.

Background to an Urgent Programme

Visits have been made to the U.S.A.F. Ballistic Missile Division, which controls the Thor programme; to the North American Rocketdyne division, which is responsible for its propulsion; and to the AC Spark Plug Division of the General Motors Corporation which produces its guidance system. Information given in these visits makes it possible to publish for the first time official details of the development of an IRBM.

This has particular significance for Britain, both because of the similarity that this programme must bear to that for the Blue Streak LRBM, and also because Britain's Thor sites make it the first country in the Western World to deploy strategic missiles operationally. Rarely can a country such as the U.S.A. have devoted so much effort to producing a weapons system for operation by its allies.

The United States Air Force has been closely interested in the development of ballistic missiles ever since the German V.2 showed the possibilities of such weapons. Between 1946 and 1952 it made intensive studies directed towards producing a ballistic missile with a range up to 5,000 miles and a destructive

ASTRONAUTICS and MISSILES

power comparable with that of manned bombers. But a seven-engined missile weighing about 1,000,000 lb. would have been needed to deliver contemporary warheads over 5,000 miles.

In 1954, a scientific committee reviewed the U.S.A.F. ballistic missile programme, and pointed out that the thermo-nuclear breakthrough which had begun in 1952 had made it possible to reduce warhead size and that it had become technically, economically and militarily feasible to produce an ICBM. The committee recommended that the ICBM programme should be accelerated, because of the highly dangerous position of the U.S. if Russia were to be first with an operational ICBM.

The accelerated programme began in 1954 under the control of the A.F.B.M.D., the Ballistic Missile Division of the U.S.A.F. Later missile programmes taken on by the A.F.B.M.D. were those for Titan and Thor, in 1955, and for Minuteman, in 1958. Today the division also has responsibility for certain space projects which are under the direction of NASA and A.R.P.A.—the Advanced Research Projects Agency of the Department of Defence.

The 1955 decision to develop IRBMs was taken because the ICBM programme was inevitably a long-term one, and it was considered essential to get a ballistic missile into service as soon as possible. The highest priority was given to Thor—as it was also to Jupiter—and when the first development and production contracts were given at the end of 1955, it was stressed that the weapons system was to be fully operational at the end of three years.

To achieve such a tight schedule for Thor as well as the tight schedules for other ballistic missiles, whose development A.F.B.M.D. controls, new project management-techniques were introduced. All technical, contracting, logistic, operational planning, programming and budgeting are centralized and this unified control has greatly accelerated the development of operational weapons systems and their supporting equipment.

The basic approach of A.F.B.M.D. is to produce a weapons system which means that all the ground-support equipment, facilities and personnel skills necessary to support an operational weapon are developed in parallel with the missile itself. Allied to this is the concept of "concurrency," which is stressed as being essential if a missile is to be brought into service rapidly.

All phases of the normal development sequence are started as nearly as possible simultaneously. As a result, research and development, operational planning, training and missile deployment, overlap instead of following each other. This involves calculated risks, in that money and effort are committed to an advanced design early in the programme.

This concept makes for difficulties, but is essential if a missile is to come into service rapidly. Training, for example, may be difficult because, initially, personnel must be trained using prototype equipment, and before all the necessary manuals have been completed.

The concurrency concept is said to be the reason for Thor reaching operational status ahead of its rival, Jupiter. An important factor in this was that Thor was put into production by Douglas virtually at the beginning of the programme and all test missiles were built on production tooling.

It is interesting to surmise whether similar streamlined techniques have been adopted in Britain for the Blue Streak. The A.F.B.M.D. emphasizes that traditional procurement methods "are out," if missiles are to become operational in the shortest possible time.

The A.F.B.M.D. organization makes an interesting comparison with the set-up in Britain. Located at Inglewood in California, the division is a headquarters of the Air Research and Development Command. Its commander, Gen. Bernard Schriever, controls and supervises all aspects of U.S.A.F. ballistic-missile weapons systems during their research and development phase.

To ensure that this is done as fast and as efficiently as possible, other major U.S.A.F. commands are represented at A.F.B.M.D. headquarters. One is the Ballistic Missile Centre of Air Material Command, which is responsible for missile procurement, production and logistics planning and organization. The other, code-named SAC-MIKE, is the office of the assistant commander-in-chief, Strategic Air Command. It prepares for the operational use of weapons systems at the same time that they are being developed.

The fourth organization in the team is Space Technology Laboratories, Inc., which provides systems engineering and technical direction of associate contractors. Its relationship with A.F.B.M.D. is on a contract basis.

Facilities and services of ten Air Research and Development Command centres are available to assist in execution of ballistic-missile programmes. One of these is the Air Force Missile Test Centre at Patrick A.F.B., Florida; missiles are flight-tested at nearby Cape Canaveral.

Thor Development

When the Thor programme began in November, 1955, proven equipment was chosen as far as possible. Thus the rocket engine was to be based on one developed as an Atlas booster. The heat-sink nose-cone under development for Atlas was chosen, as was the Atlas guidance system. Throughout the programme, the aim was to build in factors of safety. On the structural side the emphasis was on reliability rather than extreme lightness.

In December, 1955, the basic contracts for Thor were given to the Douglas Aircraft Co.—airframe assembly and test; the Rocketdyne Division of North American Aviation—power-plant; the AC Spark Plug Division of General Motors—guidance; and General Electric re-entry nose-cone.

Only 13 months later the first Thor was test-launched at Cape Canaveral. This test and three more in April, May and August, 1957, were unsuccessful in varying degrees, but gave much useful information on Thor behaviour. The first successful test launching was on September 10, 1957, when the missile flew its programmed distance.

The next month a successful long-range test was made to measure the maximum airframe acceleration and stresses. In this test a lightened Thor covered 2,850 miles. In December, 1957, the first test with a Thor which had its guidance system installed was a success.

In February, 1958, nose-cone separation tests began and in June a nose-cone data capsule was recovered after a flight of more than 1,300 miles. Two others have been recovered since then.

Thors were also test-launched in 1958 in Thor-Able re-entry tests and as the booster for moon probes. In the first series of Thor-Able tests the successful re-entry of heat-sink nose-cones has been achieved at ranges of 6,000 miles. Later ablative nose-cones have been tested.

The latest use for Thor is as the booster for Discoverer satellite launchings. The first of these was made on February 28 this year. By early April this year Thor had been test-fired 38 times, including three Thor-Ables, three moon probes, three Thor-Able 2s and one Discoverer.

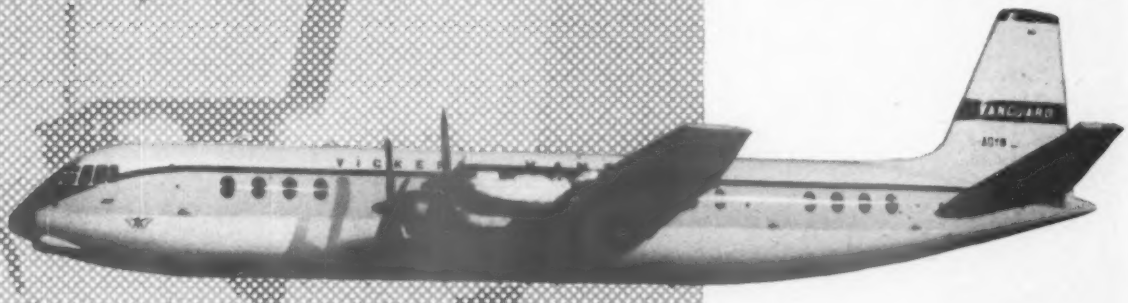
(*Continued on page 503*)

Airborne units of the AChiever guidance system for the Thor. Left, the electronic pallet containing the computer and associated equipment. Right, the gimbal unit which houses the stabilized platform and the accelerometer gyroscopes.

PROP-JET ECONOMY

The Rolls-Royce Tyne which powers the Vickers Vanguard is an advanced twin spool high compression engine, designed to give a very low specific fuel consumption — and is backed by the unique experience gained by Rolls-Royce in more than 7,000,000 hours operation of gas turbine engines in scheduled airline service. The Tyne is due to enter service in 1960 at ratings of 4,985, 5,525 and 5,730 e.h.p. Vanguards have been ordered by British European Airways and Trans-Canada Air Lines.

The Tyne will also power the Canadair CL-44 long range transport ordered for the Royal Canadian Air Force and the Short Britannic 3 for the Royal Air Force.



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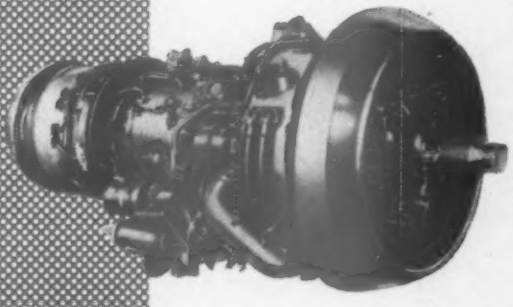

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(*Continued from page 502*)

All except two of those firings were basically research and development flights. An extensive ground and flight-test programme is under way to reduce flight-test failures and to improve further the reliability of Thor.

It is interesting to note that this missile has already made more test flights than all other U.S. ballistic missiles combined. Eight Thors have been test-fired this year and each would have satisfied the operational mission. The first Thor launching by a S.A.C. crew was at Vandenberg A.F.B. in December, 1958.

Propulsion for Thor

Thor's Rocketdyne engine was devised from the one under development as an Atlas booster. It has a single gimballed main chamber and two gimballed vernier motors for roll control and final trajectory corrections. The current model is the MB-3 with a thrust of 150,000 lb.

Propellents used are RP-1, a hydrocarbon fuel similar to kerosene, and liquid oxygen. Combustion temperature is about 6,000°F. The main thrust chamber has tubular walls through which fuel is circulated for regenerative cooling; the verniers are of double-wall construction. Propellents are supplied by twin centrifugal pumps on a common shaft driven by a single turbine which is driven by a gas generator using the rocket's propellents.

This engine was developed at Rocketdyne's Canoga Park plant and is now in production at Neosho, Missouri; it is virtually identical to the engine used for Jupiter. Developed versions of the MB-3 are to be coupled in a bank of eight to provide the coupled booster now under development for U.S. space projects. The company is also producing the 1,500,000-lb.-thrust single-chamber engine for NASA projects.

The development programme on the Thor engine has aimed at simplifying it and improving its reliability. The current engine has 30% fewer parts than the one which was first flight-tested in January, 1957. The aim is an 80% reduction to give an engine with only 12 components.

Emphasis has centred on the control system, where about 50% of the components have been eliminated. A single set of propellent tanks is now used to start the engine and to supply the verniers. This has given a big weight-saving.

A reliability programme of test firings is being made at Edwards A.F.B. One engine there has withstood 78 static firings, totalling 2 hr. 15 min.; 21 of these were for the full running time used during the Thor flight. This running time is about 157 sec.

Development testing of Rocketdyne engines is at a vast and impressive test area in the Santa Susana mountains, about 10 miles from the Canoga Park factory. Here both complete engine and component tests are made.

Guidance

An AChiever inertial guidance system used for Thor is built by the AC Spark Plug Division of General Motors at its Oak Creek plant, Milwaukee. The company received a contract for this in January, 1956, and was instructed to produce a system which would allow operational deployment of Thor within three years.

AC Spark Plug had an extensive background of inertial system knowledge, having produced a stellar-inertial bombing system, SIBS, in the early 1950s. Based on this experience it had studied an ICBM guidance system. The company was directed to produce the Thor system when the official policy decision was made to get an IRBM into service at the earliest possible date.

Thor is guided only during the powered phase of its flight, which lasts less than three minutes and extends over only some 90 miles of its trajectory. High acceleration, high temperatures and extreme vibration made achievement of the required guidance accuracy very difficult.

Because of the programme's urgency, AC Spark Plug relied as far as possible on proven techniques and hardware for Thor guidance. Because of the demands both of accuracy and low airborne weight, a computer design was chosen which left most of the computer on the ground. The major part of the flight trajectory is computed mechanically before the flight; the missile-borne computer steers the missile and cuts off thrust according to a relatively simple programme.

The three basic parts of the AChiever system are the stable platform which has three stabilization gyros and three acceleration gyros; the airborne computer; and the ground-support computer. The stable platform, which is known as the "ball," and the airborne computer in pallet form are installed in the guidance compartment which is just below the nose-cone. Weight of the airborne system is less than 1,000 lb.

The only information which must be fed into the system is the location of the target and of the launching point. Alignment of the guidance system is done when the missile is horizontal; a special theodolite is used.

A visit to the AC Spark Plug factory is a fascinating experience. Machining is to limits down to 0.00005 in. in a temperature-controlled environment. Women operators using 20x-magnification microscopes spend hours deburring and polishing gyro parts using dental equipment: as much time is devoted to this as to the basic machinery. Gyros are assembled in dust-free air-conditioned rooms where the women operators are allowed no cosmetics apart from lipstick; face powder might upset the gyros. The cutting heads of tools used for gimbal machining are temperature-controlled to within two degrees.

The Thor guidance system costs between $100,000 and $200,000. It is claimed the drift rate of the gyros used is under 0.004° per hour.

Thorough environmental tests are being made with this guidance system. AC Spark Plug can incorporate any improvements suggested by flight tests into the system within six to eight weeks. This time covers data analysis, redesign, testing and the incorporation of a major change into the production system.

ASTRONAUTICS and MISSILES

NASA Reveals its Space Programme

NEXT year the United States expects to launch more than 30 satellites and space-probes at a cost of nearly one-billion dollars; work on manned re-entry is gathering momentum, and development is in hand which envisages manned expeditions to the moon.

This ambitious programme is reflected in the existence of two organizations which have been set up to co-ordinate work in the space-sciences. One is the National Aeronautics and Space Administration, a civilian agency with a staff of 8,000 and a current budget of half a million dollars which may increase to two-billion dollars within a few years. Its military counterpart is the Advanced Research Projects Agency, which initiated work on five lunar probes and several satellite projects since passed to NASA. Other work now in progress on weather satellites and the Centaur high-energy rocket will also be handed over to NASA shortly, leaving ARPA with supervision of the Discoverer satellites, a number of navigation and communication satellites, and the Century satellite project.

In a paper recently presented before the Electronics Industries Association in Washington, Mr. T. Keith Glennan, Administrator of NASA, gave some interesting sidelights on contemporary and anticipated developments in the space-field.

Pioneer IV

Of the space-probe, Pioneer IV, launched on March 3, Glennan said the conical payload weighed 13.4 lb. and measured 20 in. in length with a diameter of 9 in. Within those limits of weight and size, there was packaged the following: two Geiger-Mueller tubes to measure radiation, one being shielded with lead to cut out all but high-energy radiation; a photo-electric sensor, shaped like a pistol to test its effectiveness near the moon in activating picture-taking mechanisms in future space-vehicles; a de-spin mechanism, to slow down the axial rotation of the probe so that the sensor could perform its mission, and telemetry equipment.

The telemetry equipment included a battery-powered radio transmitter, with three sub-carriers, designed to transmit continuously on a frequency of 960.05 megacycles for about 90 hours, using 180 milli-watts of power. The transmitter had

ASTRONAUTICS and MISSILES

to telemeter information about radiation, and about operation of the photo-electric sensor which was set to work only after the probe got within about 20,000 miles of the moon. (Actually, the closest approach was 37,000 miles and the sensor did not operate.)

There was also a monitor device, incorporating a germanium diode, to report on the radio beacon's transmitted power at the source, and an independent arrangement whereby operation of the de-spin device was telemetered to the ground station.

Pioneer IV continued to send back data until it had travelled more than 406,000 miles from the surface of the earth—the longest communications link in history—a distance approximately 32,000 miles greater than that announced by the Russians for their Lunik with an advertised payload of nearly 800 lb.

Payload Limitations

Mr. Glennan lamented that America's rate of progress in space exploration was handicapped by lack of adequate payload capacity in available launching vehicles. Even with the exceptional efforts made by the electronics industry in the miniaturization of experimental apparatus and the equipment needed to transmit data back to earth, there were very real limitations to the scope of the experiments that could be performed. Essentially, America would be limited to "first-generation" experiments for the next twelve months.

To remedy this situation, NASA was working to improve present systems and to develop improved upper-stage rockets and larger boosters, while complete vehicle systems designed specifically for space-missions were on the way. (Little more than a year ago the largest rocket engines available were of about 150,000 lb. thrust, but there are now two development programmes which require thrusts of 1.5 million lb.)

The ratio of weight between the launching vehicle of Pioneer IV and its payload was 10,000 to 1, Mr. Glennan went on, and even when launching systems of the Atlas class came into use, the ratio would still be about 1,000 to 1. The new launching systems to be in use some years from now would have a ratio between launching weight and payload of about 200 to 1 for interplanetary missions, and perhaps as low as 50 to 1 for earth-satellites.

On the subject of interplanetary probes, Mr. Glennan stressed that very great contributions were needed from the electronics industry to improve techniques of guidance, in particular to ensure that satellite and probe vehicles were guided over the entire firing period of all stages. When we begin sending space probes towards the planets, he said, we are faced with the problem of not knowing precisely where the planets are in space.

The accuracy of astronomical data is such that, in the case of Venus, our calculations may be out by as much as 50,000 miles. But even with perfect "aiming," an error of only 1 ft./sec. in launch velocity would result in a miss-distance from Venus—assuming we knew where the planet was!—of 25,000 miles.

First Venusian Probe

A first attempt to pass a probe vehicle "close" to Venus is scheduled to begin about June 3, according to NASA. The time required to reach Venus will be about 150 days, when the planet will be about 56 million miles from the earth.

The vehicle, known as Able IV, will have a Thor as a booster, a second-stage Vanguard engine, and a solid-propellent third stage. Its planned payload is about 80 lb. The same tracking network will be used for this probe as was used for Pioneer IV, though from the 60th to 150th day after launching only Jodrell Bank is likely to be effective.

The following day (June 4) NASA reports that an attempt will be made to launch a payload of about 325 lb. on its way to Venus, using an Atlas ICBM. The probe will incorporate a retro-rocket to put it into a wide elliptical orbit around the planet. Needless to say, the chances of success are not high.

As these projects develop, the problems of tracking and receiving data from probes operating at greater distances from the earth will become increasingly acute. The Americans envisage setting up 85-ft.-diameter directional radar dishes in Australia and South Africa, similar to the one at Goldstone Tracking Station recently completed in the Californian desert by the Jet Propulsion Laboratory.

But this is only a beginning. For the communications link, scientists are looking to the installation of masers* and parametric amplifiers in conjunction with the radar equipment.

* Microwave amplification by stimulated emission of radiation.

Discoverer II Goes in Orbit

FROM Vandenburg Air Force Base, California, came news that on April 13 the United States had put into a stable polar orbit the 1,600-lb. satellite, Discoverer II. Its initial perigee and apogee were stated to be 156-243 miles, though its speed (17,000 m.p.h.) was low, and its period 90 minutes, so that its lifetime was not expected to be much more than a month. It will be remembered that Discoverer I, launched February 28, ceased radio transmission as it went into orbit and was "lost."

It is significant that the Discoverer series of satellites are far heavier than any the U.S. has launched before, apart from the empty shell of the Atlas-B fired last December. This suggests that U.S. policy has changed. Satisfied with the space environment data acquired by previous small satellites, the Americans have begun to implement the next phase in their plans to put a manned recoverable capsule into orbit in three years' time.

Discoverer II carried two separate sets of instruments. One consists of telemetry and communication equipment for recording and reporting the behaviour of the satellite, which it is thought may be attitude-stabilized. This part weighs 245 lb. The second set of instruments are contained in a "re-entry vehicle," weighing 195 lb., that includes a retarding rocket. The payload, which it was hoped would return to earth and be recovered, consisted of a stack of photographic plates. From these could be analysed the incidence and intensity of any cosmic ray hits registered above the atmosphere whilst in orbit.

It was planned that the satellite should eject this capsule 24 hours after launch, whilst on its 17th revolution. Once the ejected capsule had successfully negotiated the difficult re-entry stage it would be lowered by the opening of a parachute. Flight crews would be standing by to pick it up with nets.

Unfortunately, as was later announced, something went amiss in the timing. The capsule is now thought to have ejected, but probably descended over the polar regions.

The Discoverer launching vehicle is a two-stage rocket. The first stage is a Thor IRBM that fires for 2½ minutes and then coasts for about the same time before separating and igniting the Discoverer stage. The latter is a relatively large rocket, 18.8 ft. in length, 5 ft. diameter, propelled by a Bell Hustler engine. The fuel is a hypergolic mixture of nitric acid and a hydrocarbon.—J.G.S.

Weather-reconnaissance Satellites

AT the World Meteorological Congress now in session in Geneva, Mr. H. Wrexler, of the U.S. Weather Bureau, Washington, in his report to the Secretary-General of the United States, has advocated the increased use of weather-reconnaissance satellites for global synoptic forecasts. In his view a regular system of spaced satellites would keep track of all major storms, note the birth of new ones and the dying away of old ones.

He envisaged a family of six satellites revolving round the earth in circular, quasi-polar orbits at a height of 4,000 miles. These satellites would be spaced on meridians of longitude 60° apart, each with four-hour periods. Thus there would always be three daylight satellites moving north at the same latitude, whilst their opposite numbers moved south in parallel during the night. The possibility of collisions over both poles may be regarded as remote.

In addition to these six equi-spaced satellites there would need to be other "low-flying" satellites, operating at heights of only a few hundred miles to supply information on small scale meteorological phenomena for short-range forecasts. There would also be a system of communication satellites, sited at high altitude (22,000 miles) above the earth which will, in effect, "hover" over fixed points on the equator. These would serve as line-of-sight transmission relays for telecommunication and world-wide broadcast of television services.—J.G.S.

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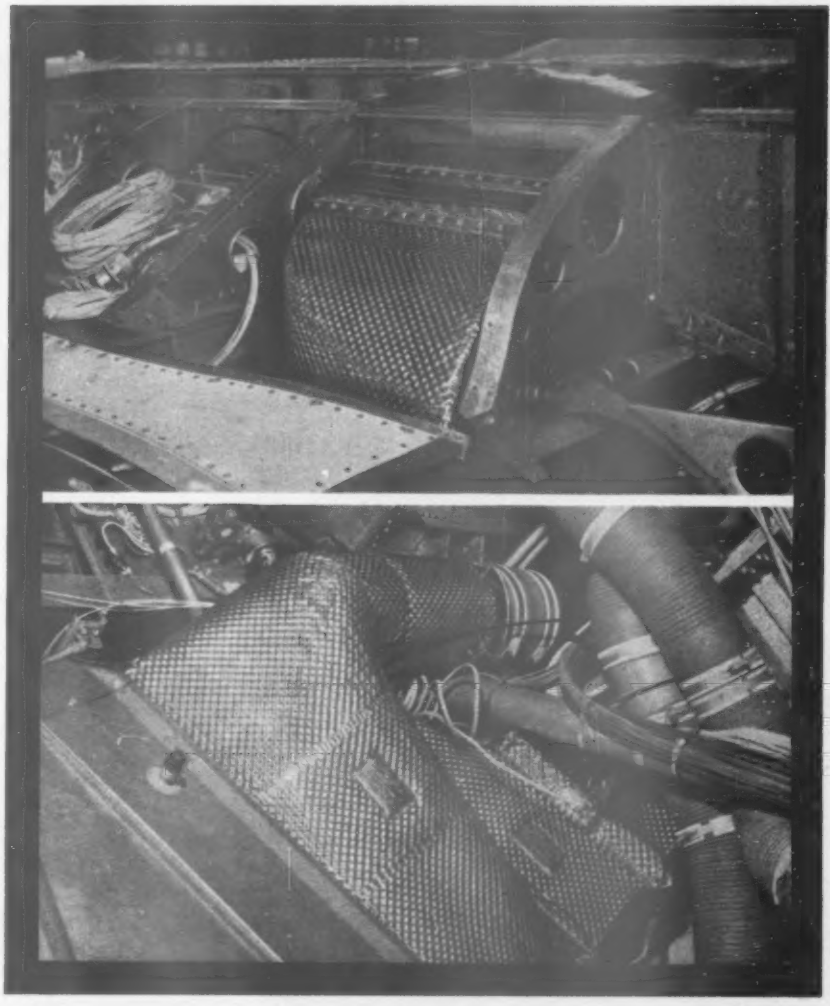

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Britannia 312's play leading part in first-ever round-the-world jet airliner service

Latest evidence of Britannia dependability and operating economy is provided by BOAC's enterprise in setting up the first-ever round-the-world jet airliner service.* This achievement by a British airline using British aircraft makes it possible to fly round the world in 3 days, 14 hours, 50 minutes—less than 87 hours, a figure expected to be reduced soon to under 80 hours.

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Already Britannia routes encircle the earth, service almost every major city in the world. Britannias fly over 2½ million miles a month; show unique range flexibility by covering stage lengths ranging from 300 miles inter-city to nearly 5,000 miles transpolar. They make no special demands on length and strength of existing runways.

At the same time Britannias are attracting new traffic with their quiet comfort and cruising speeds of over 400 mph—at least as high as any turboprop or piston-engined airliner in service anywhere in the world today. They prove their versatility by carrying a tremendous variety of freight loads, and bring profit to operators.

New traffic

Since introducing Britannias, El Al Israel Airlines have trebled their share of transatlantic traffic, while Canadian Pacific Airlines on their transpolar Vancouver-Amsterdam route in 1958 gained a 32% increase in westbound traffic over the same period of the preceding year.

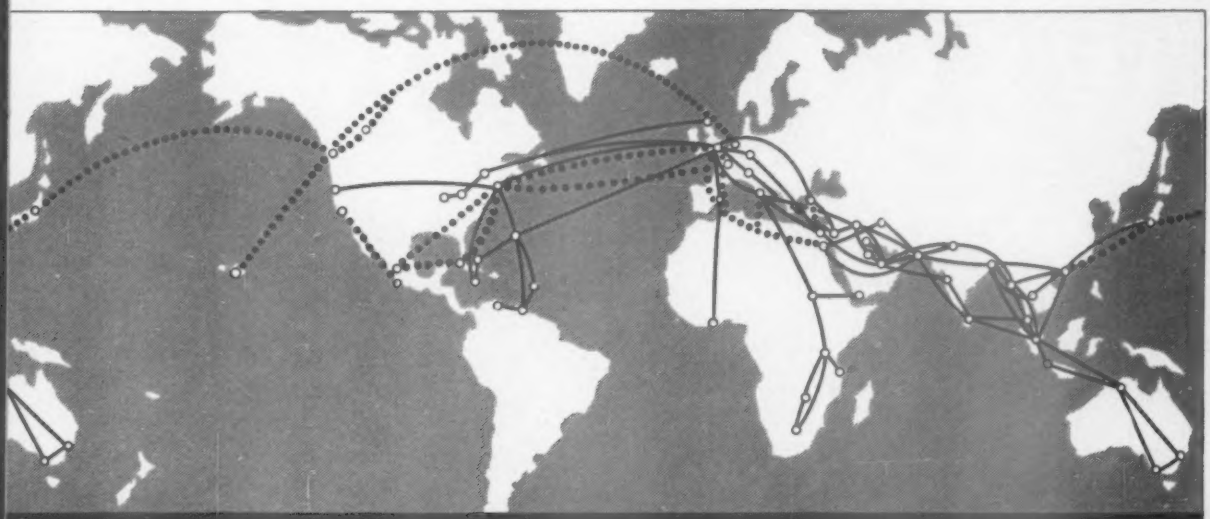
Big Charter assignments

Air Charter Ltd. Britannia flights between Christmas Island and Great Britain have been carrying no less than 128 persons—largest-ever passenger loads regularly carried across the Atlantic by a civil operator. Only 15 days after receiving their first Britannia, Air Charter had completed a full route-proving programme across the Atlantic and Pacific; the aircraft was thus earning money almost at once. Furthermore, in its first three months, it achieved an average utilisation of 7.28 hours a day.

Hunting-Clan Air Transport experience, too, has proved the Britannia unequalled at carrying large payloads at high speed over long distances. Recently a Hunting-Clan Britannia flew round the world in 65 hours flying time—a distance of 24,000 miles at an average speed of 374 mph. On the Christmas Island-London leg of the flight the aircraft was carrying 127 persons.

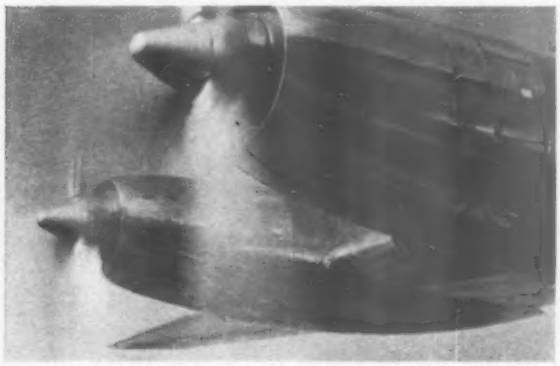
Engine reliability

Britannia operating economy is rooted particularly in the proven reliability of its Proteus engines. Overhaul life on the Proteus 705 series reached 2,000 hours in under 2 years. No engine of comparable power in service today


Britannia routes encircle the earth, service almost every major city in the world
BOAC, CAA, EAA, GHANA AIRWAYS
EL AL, CPA, AERONAVES, CMA, CUBANA

reliability, profitability BOAC enterprise

has an overhaul life that even approaches this length. Annual engine overhaul costs for BOAC's Britannia 102's have been cut by 75% since the aircraft went into service. Continued development will give Proteus even longer overhaul life, entailing even lower operating costs.



Meanwhile, current versions of the engine give greater power, lower fuel consumption, and materially improve the Britannia's cruising speed, range, and take-off performance.

Finally — Britannia overall profitability is evidenced by airline experience. *El Al's Britannias are operating at a ton/mile cost approximately 20% less than any previously experienced.*

Other recent Britannia airline achievements

BOAC extend Britannia services—to Venezuela via Bermuda, Nassau; across USA to San Francisco; and via Montreal to Detroit and Chicago.

Ghana Airways—a BOAC associate—introduce Britannias on weekly London-Barcelona-Accra service on April 14.

Aeronaves de Mexico Britannia services have been slicing more than an hour off previous Mexico City-New York schedules. Now an Aeronaves de Mexico Britannia has flown Mexico City-New York in 4 hrs 57 mins (437 mph), beating own record (of 5 hrs 2 mins) made only the previous week. Load factors have been extremely high.

Cubana de Aviacion fly return journey after inaugural flight Havana-Mexico City in record-breaking 2 hrs 53 mins—shortly to set up Britannia services Havana-New York, and transatlantic via Azores to Madrid.

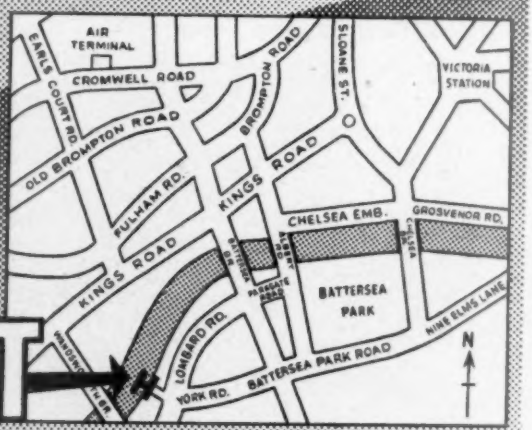
* Subject to Governmental approval

BRISTOL
Britannia

BRISTOL AIRCRAFT LIMITED

WESTLAND
opens the WAY

STRAIGHT IN TO



WESTLAND
HELIPORT
LONDON

YORK & LOMBARD ROADS · BATTERSEA · S.W.11

Pointing the Way

APART from being one of the country's leading centres of long-distance surface travel, Southampton has in recent years established for itself something of a name as an important centre of academic and practical aeronautics. And as one of its more valuable contributions, the University there every year plays host to a large gathering of members and guests of the Institution of Production Engineers whose annual conference on various matters concerning the production of aircraft has become an established event in the aeronautical calendar.

At the conference on April 16 and 17, the matters discussed by delegates were this year by no means confined to production *per se*. A contributory factor to this was undoubtedly the choice, as the overall theme of the conference, of the thesis: "The Aircraft Industry—a National Asset." This gave speakers considerable scope to discuss the overall picture as they saw it and they took full advantage of the opportunity.

Space here does not permit more than a passing reference to the three papers presented—"The Operator," by Lord Douglas of Kirtleside; "The Industry," by Mr. P. G. Masefield; and "The Impact on Other Industries," by Mr. S. P. Woodley. In each case the printed paper, which can be obtained from the Institution, offers a valuable summary of the current situation in the subjects concerned and needs to be read in full.

By way of a preamble to the conference, the guest speaker at the opening luncheon, Air Chief Marshal Sir Claude Pelly, Controller of Aircraft at the Ministry of Supply, sketched in the background. After discussing the Defence White Papers of 1957 and 1959, he said that there was much challenging work ahead for the aircraft industry—although some reduction in production capacity was inevitable. The real significance of the industry to the country, he said, was that it blazed the trail of advanced technical development.

Of the technical sessions that followed, one's immediate impression is that never can there have been a gathering of aircraft production engineers at which so little mention was made of production problems. It was, perhaps, only to be expected that almost the entire discussion ranged around civil aviation affairs—following somewhat naturally from Lord Douglas' paper which had started the conference off on a civil footing. This, it should be explained, constituted the annual Lord Sempill Paper; by custom it formed the opening contribution, and was not discussed.

The Masefield paper proved to be the masterly analysis with data and graphs that one has come to expect from him. It succeeded most admirably in providing a comprehensive survey of the position facing the industry which, the author said, might in two years from now employ 100,000, or 40%, fewer than at present. Although, as we have said, we do not propose to deal with the papers at any length, it is worth recording here some of Mr. Masefield's more general statements and conclusions for, in effect, they formed the text of the conference as a whole. His comments on supersonic transports are recorded and discussed in an editorial.

He suggested, for example, that what he called "the great divide" in civil transport was facing the industry. The possibilities were, on the one hand the high-speed/high-fare transport and, on the other, the moderate-speed/low-fare vehicle. In the first, supersonic, category the operating cost would be very much higher than present values. The low-fare development offered a vast and untapped market and there were possibilities of sweeping reductions in operating cost.

A Policy Required

There was, he argued, a dominant need for clear and concise thinking and for policy decisions on the part of the Government. Unless such a policy was determined, the industry might well fade away into other pursuits. Unless such defence and civil orders as were available were planned to follow on in proper sequence design teams—which have taken decades to build into an irreplaceable repository of knowledge—could not be kept in being. Nor could production facilities achieved at high cost be kept potent unless there was a long-term solution to the constant problem of matching production requirements to production capacity.

Proposing that a policy of a strong British aircraft industry should be established with clear objectives within the financial terms decided, he suggested a defined field of endeavour should be set in the five main categories of aircraft—transport, general aviation, manned military aircraft, guided flight and helicopters. Within each clear targets should be set.

State-sponsored research and development programmes should be planned to cover each category. Financial support for a series of major projects should be determined. The responsibility of the State airways corporations for initiating development of British aircraft to meet their future needs, should be defined again with clarity and supported with money. And a policy of encouraging British aeronautics generally should be established.

"In an industry so bound up with national well being," said Mr. Masefield, "the inescapable fact is that unless a forward policy for British aeronautics is established, after the most careful analysis of all factors, and that policy is then implemented at the cost it requires to achieve success, then we shall fall behind for ever in maintaining our position as a world power."

A number of interesting points were raised in the subsequent discussion. It was thought, for example, that insufficient emphasis was placed on increasing domestic aviation in the U.K. and that the successful development of automatic take-off and landing techniques should be applied for this purpose. The stimulating idea was put forward that the growing congestion in surface freight transport pointed the way towards an efficient air transport service which could use not tens but hundreds of specially designed aircraft and special freight airports throughout the world.

On the second day, the proceedings were opened by Mr. S. P. Woodley whose own written paper set out to show how the aircraft industry benefited others. He contented himself with a very brief résumé of some of his main points and very generously sacrificed some of his allotted time so that more would be available for the main discussion period to follow.

Open Forum

This was an innovation at the conference this year. The second half of the winding-up session was devoted to a "brains trust" with Mr. Eric Turner, Lord Douglas, Peter Masefield, and Mr. Woodley facing a barrage of questions—with Prof. E. J. Richards making an admirable chairman.

This was indeed a very lively session and an experiment that should be taken as successful enough to warrant including similar sessions in future conferences of this sort. Here again, the atmosphere was more of policy than of production, although one questioner did ask that the Institution should organize a conference devoted to matters of fundamental research into production problems; and a member of the panel agreed that in the past too large a proportion of research and development expenditure had gone into the design side and not enough into production which tended to lag behind.

A question was raised about the likely impact of Russian competition in the commercial field. Answers suggested that while there undoubtedly would be more operational competition, commercially there would be difficulties in the way of certification by A.R.B. and C.A.A. of Russian passenger aircraft.

Lord Douglas' remarks about the airlines' inability to make a profit on the short hauls of less than 200 miles were questioned. This led to comments from the panel—not by Lord Douglas—that the airline passenger on such short journeys was cosseted too much. The prospects of VTOL aircraft in shortening time spent on the ground by enabling city-centre to city-centre travel were underlined and it was hoped that aircraft such as the Rotodyne would help the economics.

One questioner touched upon a delicate point by asking whether, in view of the marginal state of the industry at present, a good accountant was more important than a good designer or engineer. The short answer was no—that design and manufacture of aircraft was essentially a team job. But it was also thought that in the years to come when the industry was diversifying, more accountants would be relatively more important than in the past.

The $64-question, however, came towards the end of the session. Attention, it was said, had been focused on the civil field in two directions—speed and prestige and economy and profit. In each, heavy Government support would be required. If the Government agreed to help, but only in one of these directions, what would be the Panel's choice?

In answer to this they came down heavily on the side of the mass-travel low-cost project, because that would be the one from which large-scale production and employment would come. It was, however, pointed out that it would mean official support of rather a special kind—in addition to the financial sort. If we produced a really cheap aircraft offering really low fares, there would be considerable reaction from abroad against undercutting existing fare rates.

This would mean that the Government would have to get tough internationally; but if we meant business and really produced such an aeroplane we might in the end sell some to the Americans. And this was a note of optimism and enthusiasm with which most members of the conference seemed to be in sympathy.

Astronautics and Missile News

CANADIAN SUPPORT.—The Boeing Airplane Co. has negotiated a contract with de Havilland Aircraft of Canada, Ltd., for engineers to aid Boeing's applied physics staff in a study of the application of advanced electronic techniques for the Bomarc missile programme. This is the second Canadian firm to co-operate: Canadair, Ltd., is to build Bomarc wings and ailerons in Canada.

ASTRONAUTICS LECTURES. — A series of lectures on "Astronautics and Space Sciences," organized by the University of Rome and AGARD, is to be held in Rome from May 18 to 29. Subjects to be covered will include aviation medicine; astronomy; guidance; atmosphere; communications; structures; materials; aerodynamics; thermodynamics and propulsion.

WOOMERA SURVEY.—A two-year survey covering a 2,500-mile route across Australia is to be made so that precise distance checks can be made on long-range test firings from Woomera.

FUEL ON ORDER.—A five-year contract has been awarded by NASA to the Linde Company—a division of Union Carbide Corpn.—for liquid hydrogen needed for a number of projects, such as Centaur (Atlas, plus second-stage liquid hydrogen unit, plus new third stage).

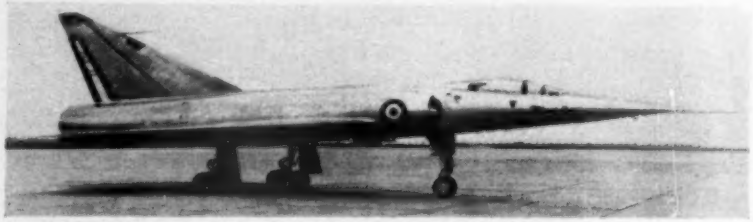
VEGA ROCKET. — The National Aeronautics and Space Administration has announced the signing of a $5 million contract with the General Electric Co. for development of a liquid-propellent engine to power the second stage of the Vega space vehicle. The engine will be a modified Vanguard first-stage engine.

ROCKET DEVELOPMENT. — The Italian Bombrini-Parodi-Delfino chemical company has signed an agreement with the French SEPR concern whereby B.P.D. will draw on SEPR experience to develop solid-propellent rockets.

General Aviation News

ARGOSY PROGRESS.—More than 100 hr. of test flying has been completed by the two A.W. Argosies since the prototype flew on January 8. The second aircraft, G-APRL, was illustrated in our issue of April 10. The third was taken to the flight sheds at Bitteswell on April 14 and the fourth should be flying by the end of next month. The type will be seen at the forthcoming Paris Aeronautical Salon.

AUTOGIRO REVIVAL.—A new version of the original Kellett Autogiro, known as the Cropmaster, is being built for agricultural work. This two-seat aircraft, with a 225-h.p. Jacobs L4-MA engine, has a three-blade 40-ft. rotor. Overall dimensions with the rotor folded are: Length, 26 ft.; width, 10 ft. 3 in.; and height, 10 ft. 10 in. A 17-cu.-ft. tank or hopper is installed, and the estimated cost is $20,000. Weight empty, 1,500 lb.; useful load, 800 lb. Minimum speed, 20 m.p.h.; cruising speed, 120 m.p.h.; rate of climb, 1,060 ft./min.; service ceiling, 14,000 ft.



NEW MIRAGE.—Powered by two SNECMA Atar 9 turbojets, the Dassault Mirage IV A delta-wing bomber is expected to make its first flight by the end of this month.

J75 OUTPUT.—It is announced that the Pratt & Whitney J75 twin-spool axial-flow turbojet with afterburner develops 24,500-lb. thrust, and 26,500 lb. with water injection. The type powers the Republic F-105 and Convair F-106. The commercial version, the JT4 without afterburner, powering the Boeing 707 and Douglas DC-8, delivers 15,800-lb. thrust, and a new version will provide an extra 1,000 lb. It weighs 5,875 lb. and is 19 ft. 8 in. long with a diameter at the compressor inlet of 43 in.

NEW ALLISONS.—Low cost, light weight and simplicity were design aims of the 250-e.s.h.p. T63 gas-turbines by the Allison Division of General Motors Corpn. The turboprop version has an s.f.c. of 0.70 lb./hr./e.s.h.p., weighs 110 lb. and is 38.5 in. long with a maximum height of 19.5 in. As a turboshaft it weighs 95 lb. and is 34.6 in. long with similar height and s.f.c.

EXECUTIVE. — Developed from the Dassault MD-315 Flamant is this MD-415 Communauté, powered by two Turboméca Bastan turboprops, for liaison and executive work. The MD-410 Spirale is a projected ground-attack variant.

NEW RUSSIAN BOMBER.—Gen. N. F. Twining, U.S.A.F., chairman of the Joint Chiefs of Staff, recently reported that Russia has a new advanced heavy bomber, "a kind of big delta wing, with very long nose section and long engines"; this aircraft, "which we have seen," has a performance "way beyond the capability" of the Bison turbojet and Bear turboprop long-range bombers.

HELICOPTER RALLY.—The fourth helicopter rally and garden party of the Helicopter Association of Great Britain is to be held at Dunsborough Park, Ripley, Surrey, on June 6.

Commercial Aviation Affairs

NO NIGHT JETS.—No permission has been given by the M.T.C.A. for the operation of jet aircraft at London Airport at night. This was said by Mr. Watkinson in the House last week, referring to Pan American's proposal to operate a second daily 707 service to New York from London Airport, departing at 01.30 hrs.

FEBRUARY TRAFFIC.—Provisional M.T.C.A. figures for U.K. airlines traffic on scheduled and I.T. services during February show an increase of 10% compared with February, 1957. Capacity operated increased by 11%. Figures for January and February traffic together show an increase of 12% over the 1957 figures.

S.A.S. CARAVELLE DELIVERED.—The first Sud-Aviation Caravelle for S.A.S. was handed over at Toulouse on April 13, and was named "Finn Viking" by Mrs. A. Rusck, wife of the S.A.S. president. It was flown to Stockholm by a crew including pilots representing Sweden, Denmark and Norway.

AEROFLOT NEWS. — Tupolev Tu-104B 100-seat turbojet transports have been put into daily service on the Moscow-Leningrad route this month. As part of Aeroflot's programme to bring its operations more into line with Western practice, half-price fares for children under 12 were introduced on April 15, and the free baggage allowance was doubled, to 20 kg. (44 lb.). Il-18 turboprops will be used during the summer on non-stop services from Moscow to Adler and from Moscow to Alma Ata.

CONVAIR 880 INCIDENT.—On its 26th flight, made during March, the first Convair 880 suffered the loss of a major portion of its fin and rudder, according to *Aviation Week*. The failure occurred during a high-speed dive which was part of a flutter investigation. The 880 was safely landed at Edwards Air Force Base by Don Germeraad, using differential engine power for directional control. It has now been repaired and is flying again from San Diego.

COMET DELIVERIES.—The ninth Comet 4 for B.O.A.C. was delivered on April 16, and the 10th aircraft was rolled out on April 17.

CANTON RIGHTS.—Air Ceylon will shortly inaugurate a service between Colombo and Canton via Singapore and Rangoon. Traffic rights at Canton were obtained for Ceylon by a delegation which recently visited Peking; reciprocal rights were offered to China but may not be taken up.

ARLANDA PROGRESS. — Every effort is being made to complete Stockholm's new £10,500,000 international airport at Arlanda next year. Initially the main runway length will be 7,500 ft., with extension planned to 10,000 ft. S.A.S. will build a hangar at Arlanda for line maintenance of DC-8s, Caravelles and DC-7Cs, but major overhauls of the S.A.S. fleet will continue to be at Copenhagen.

F-27A CERTIFICATE.—Full F.A.A. certification has been obtained by Fairchild for the F-27A with 2,015-e.h.p. Dart 528 (R.Da.7) engines. The first airline to use this version of the F-27A is Bonanza, which started services in the Southwest as soon as the certificate was obtained; other F-27As have already been delivered to business owners and airlines.

SECOND COMET OPERATOR.—On April 16 Aerolineas Argentinas became the second airline to operate the Comet 4, inaugurating their service between Buenos Aires and Santiago de Chile. The third Argentinian Comet was demonstrated at London Airport on April 20 and was to leave for Buenos Aires on April 22.

FRIENDSHIP ARRIVAL.—The first T.A.A. Friendship landed in Sydney on April 16 at the end of its delivery flight from Holland.

ALTIMETER DOUBT.—A Kollsman needle-and-drum altimeter in an American Airlines' Electra is reported to have given a faulty reading of some 600 ft. during a landing at Detroit recently. Altimeters of this type had been retained in American's Electras, for test purposes only, since the F.A.A. ordered the use of the older three-needle type following the crash of an Electra last December.

News About People

ROYAL PATRONAGE.—H.R.H. The Duke of Edinburgh has graciously accepted the presidency of the College of Aeronautical and Automobile Engineering, Chelsea, as from November 2 next for a period of one year. He succeeds Lord Brabazon, who has held the office since 1950.

HAWKER BOARD.—In line with the recent reorganization of the aviation interests within the Hawker Siddeley Group and their consolidation under Hawker Siddeley Aviation, Ltd., the following appointments have been made at Hawker Aircraft, Ltd.: managing director, Mr. J. T. Lidbury; chief engineer, Sir Sydney Camm; executive director and chief designer, Mr. R. H. Chaplin; executive director, Mr. E. G. Rubython; directors, Mr. J. A. R. Kay and Mr. S. D. Davies.

DUMBARTON RETIREMENT.—Sir Maurice Bonham - Carter, K.C.B., K.C.V.O., has retired as chairman of Blackburn (Dumbarton), Ltd., and Mr. T. Bancroft, O.B.E., has resigned through pressure of work. Sir Maurice is succeeded by Mr. A. F. Jopling.

ROTOL DIRECTORS. — Following the outright purchase of Rotol, Ltd., by the Dowty Group, Sir George Dowty and Mr. R. F. Hunt, respectively chairman and deputy chairman of the Dowty Group,. Ltd., have joined the board of Rotol. Sir George has been elected chairman and Lt.-Gen. Sir John Evetts deputy chairman.

TRANSATLANTIC.—The nose section of the English Electric Canberra which flew the Atlantic twice on August 26, 1952, was presented to the National Aeronautical Collection on April 15. With it here are, right, Viscount Caldecote, deputy managing director of English Electric Aviation, and Dr. T. C. S. Morrison-Scott, director of the Science Museum.

Photograph copyright "The Aeroplane and Astronautics"

BRISTOL PILOT.—Mr. T. P. Frost, chief test pilot of Armstrong Siddeley Motors, Ltd., since 1955, is appointed to a similar post with Bristol Siddeley Engines, Ltd.

RUSSIAN MANAGER.—Mr. M. S. Brander has been appointed B.E.A. manager, Russia. He was previously station manager in Rome. A B.E.A. Viscount was making a proving flight to Moscow on April 21, prior to the introduction of the regular London/Moscow service in mid-May.

ENGINE POSTS.—Mr. F. T. Blakey has been appointed a special director and a joint business manager of Bristol Siddeley Engines, Ltd.; Mr. Frank Shutt succeeds him as secretary of the company.

BALPA CHAIRMAN.—Captain R. T. Merrifield, a senior B.E.A. captain has been re-elected chairman of the British Airline Pilots' Association for the current year. He will be serving in this office for the third consecutive year.

F. HOINVILLE.—We regret to record that Mr. Fred Hoinville, celebrated Australian sailplane pilot, was killed in an air accident on April 17.

Military Aviation Affairs

H.M.S. "EAGLE."—H.M. The Queen is to spend 4 hr. at sea on board the carrier "Eagle" on April 29. During the visit Her Majesty, accompanied by the Flag Officer Aircraft Carriers, Vice-Admiral C. L. G. Evans, is to inspect the ship and see a flying display by Sea Hawks of Nos. 806 and 898 Sqns., Sea Venoms of No. 894 Sqn., Gannets of No. 814 Sqn., Skyraiders of No. 849A Sqn., and the carrier's helicopters.

R.A.F. APPOINTMENTS. — Air Marshal Sir Edward Chilton, K.B.E., C.B., is to become A.O.C.-in-C., Coastal Command, on June 1, in succession to Air Marshal Sir Bryan V. Reynolds, K.C.B., C.B.E., who will retire from the Service. The post carries also the NATO appointments of A.O.C.-in-C., Eastern Atlantic Area, Allied Command, Atlantic; and Allied Maritime Air C.-in-C., Channel Command. Air Vice-Marshal Cheshire, C.B., C.B.E., has been appointed as A.O.C., Malta, as from May 19, with acting rank of Air Marshal. He will also hold the NATO post of Air Deputy to the Allied Forces Mediterranean.

AUSTRALIA TOUR. — Four McDonnell RF-101 Voodoos will be the highlight of the U.S.A.F. contingent which will tour Australia for this year's Operation "Handclasp." The RF-101s will be accompanied by two Douglas WB-66s and four Lockheed C-130s.

BERLIN HIGH FLIGHTS.—Continuing the American policy of operating transport aircraft at their most economical heights in the Berlin air corridors, the U.S.A.F. has flown several sorties with Boeing C-97s and Lockheed C-130s above the Russian "ceiling" of 10,000 ft. On each occasion Soviet MiG fighters appeared and either flew in close escort to the American aircraft or "buzzed" them.

U.S.A.F. EQUIPMENT. — Seventy Boeing B-52H Stratofortresses (Pratt & Whitney J57 turbofan engines) are to be acquired by the U.S.A.F. during the 1960 fiscal year, also 96 Boeing KC-135 Stratotankers.

TO RHODESIA NON-STOP.—These pictures, the first to show recent air-to-air refuelling by R.A.F. Bomber Command, were taken from a Canberra at about 40,000 ft. over the Sahara during the flight of a Valiant of No. 214 Squadron from Marham, Norfolk, to Salisbury, Rhodesia, on April 16. The Valiant, piloted by Wg. Cdr. M. J. Beetham, D.F.C., covered the 5,319 miles in 10 hr. 17 min., an average speed of 516 m.p.h. The tanker Valiant, piloted by Sqn. Ldr. J. H. Garstin, was based at Idris, Tripoli.

LACROSSE IN SERVICE.—The first two U.S. Army units equipped with the Martin Lacrosse SSM are to be formed by June 25 at Fort Sill, Okla. They are the 5th Missile Btn., 41st Artillery, and the 5th Missile Btn., 42nd Artillery.

R.A.F.A. "AIR WEEK."—H.R.H. Prince Bernhard of the Netherlands has accepted an invitation from the R.A.F. Association officially to open "Air Week" at Brighton and to attend the Association's air display at Shoreham Airport on May 30. The opening ceremony will take place at Old Steine, Brighton, at 11.30 hrs. and Prince Bernhard will attend a civic luncheon before returning to Shoreham for the air display at 14.30 hrs.

U.S. OCCASION.—The U.S.A.F. will be "At Home" to the public at R.A.F. Weathersfield, Essex, on May 9.

MARINE DESIGNATION.—The 20-25-seat version of the Sikorsky HSS-2 (illustrated in THE AEROPLANE, March 27) for the U.S. Marines is designated the HR3S-1.

NATO MISSILE EQUIPMENT.—U.S. military authorities announced on April 9 that by the end of this year more than 35 units equipped with U.S. missiles will be in service in Europe. They include 21 battalions of Honest John SSMs; nine battalions of Nike SAMs; two battalions of Corporal SSMs; one squadron of Matadors, and at least two squadrons of Thor IRBMs. Countries receiving one or more types of missile this year are Britain, Norway, Denmark, The Netherlands, France, West Germany, Italy, Greece and Turkey.

Vacuum-melted Metals

ONE of the most interesting developments of recent years in the production of new alloys and metals has been the introduction of melting in vacuum. Generally known for its application in the manufacture of such metals as titanium and zirconium, which must be essentially melted in the absence of air because they contain elements which readily oxidize, this process has also been found to improve the characteristics of a number of existing steels and has brought about the production of new alloy steels.

At the Brightside Works, Sheffield, of Jessop-Saville, Ltd., the process has been in operation for the production of titanium ingots since 1956, when the Jessop vacuum-melting plant came into full-scale use. But with the increase in demand for such vacuum-melted metal, particularly in the form of larger forgings, the company has extended its production facilities, and recently two new furnaces came into full operation.

The first of these is a Heraeus consumable arc-melting furnace capable of melting titanium ingots up to 24-in. dia. and weighing more than 2½ tons. The second is a 600-lb. Wild Barfield/N.R.C. high-frequency induction-melting furnace, which Jessop-Saville employ for the melting of high-grade iron, nickel and cobalt-base alloys. Each of these furnaces is stated to be of the largest type in this country and in combination provides the largest operational vacuum-melting plant outside the U.S.

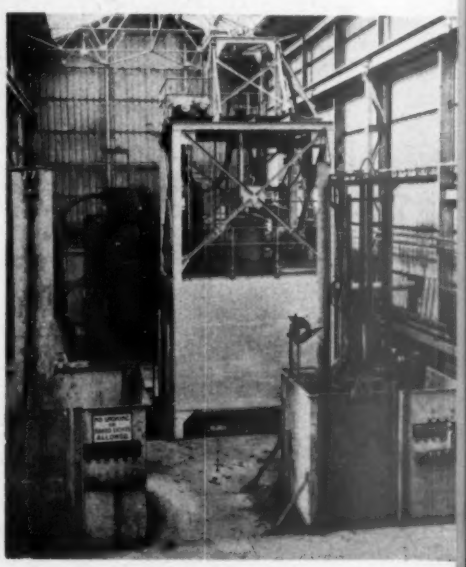
In the Heraeus installation the melting furnace consists of a large vacuum-tight vessel evacuated by high-capacity pumps. The actual melting is undertaken in a copper crucible which forms the lower half of the furnace. An electrode is placed inside the furnace, where it is welded on to the feeder rod, under high-vacuum conditions. The melt is started by striking an arc between the bottom of the electrode and a small charge placed at the bottom of the crucible. Enough heat is generated by the arc to melt the tip of the electrode, and the molten metal sprays down to form a pool which, when solidified, forms the ingot.

It is possible to apply a current of 18,000 amp. to the electrode and the vacuum equipment can hold melting pressures below 1 micron. In addition, the plant can produce zirconium ingots, but it is likely that initial production will be confined to ingots of up to 800 lb.

The Wild Barfield/N.R.C. unit is designed for semi-continuous operation, provision being made to accommodate enough ingot moulds for several heats on a rotary mould table, and for charging the furnace through a bulk-charging hopper without breaking the vacuum in the melting chamber. A horizontal unit of stainless steel, the vacuum chamber contains the induction-melting coil which tilts about the pouring axis. The alloy-charging mechanism is contained in a cylindrical chamber on top of the melting chamber.

Turbine- and compressor-disc materials used in gas-turbine aircraft engines must be virtually free from non-metallic inclusions. Vacuum melting reduces the total gas content of the metal and tests have shown that with air-melted steel remelted in vacuum the total oxygen, hydrogen and nitrogen of the steel is reduced from 600 parts/million to 200 parts/million. Tensile tests on vacuum-melted 12% chromium-steel discs have, for instance, given elongation values four times greater than those obtained on discs made from air-melted material.

One alloy containing high percentages of aluminium and titanium produced by this method is Jessop G.64. Having good high-temperature properties, it is being assessed for stator- and turbine-blade applications.



The Heraeus consumable arc vacuum-melting furnace at the Brightside Works of Jessop-Saville, Ltd., Sheffield. It can produce titanium ingots from 9-in dia. (120 to 420 lb.) up to 24-in. dia. weighing 2½ tons.

Correspondence

Defeating the Bomber Boys

IN his review of my book "Heavenly Adventurer" in your issue of April 3, "Polygon" chides me for suggesting that Sir Sefton Brancker, rather than Lord Trenchard, won the fight for a separate air force after the First World War.

I do not think that I did make that suggestion. At any rate I have never doubted that Trenchard's persistence played the chief part in defeating attempts to abolish the separate air force. The point I tried to make was that Trenchard himself recognized that Brancker's efforts as propagandist also made a handsome contribution.

Probably all airmen and most military historians will agree with your reviewer's further comment that, had that peacetime struggle not been won, "we should have lost the Battle of Britain and the Hitler War." Perhaps, however, you will allow me to add that recognition of Trenchard's achievement ought not to blind us to the danger we still ran of getting the wrong kind of separate air force.

Between the Wars neither the Air Ministry nor the War Office paid enough attention to air support for troops. Obsessed by the "strategic" bomber, Trenchard and his school were slow to understand the crucial importance of the fighter. To say nothing of later contributions, we were in a position to win the Battle of Britain when the time came largely because in 1938 Sir Kingsley Wood, advised by Sir Thomas Inskip, insisted in the teeth of the "bomber boys" that production of fighters should have priority over that of bombers.

Falmer, Sussex. BASIL COLLIER.

Transatlantic Fares

TWO years ago, in the summer, my wife and family flew to the U.K. for a short holiday. This summer, I hope her mother may fly out here to visit us.

Having followed with great interest the glowing articles and advertisements in THE AEROPLANE about all these new aircraft, and particularly how cheaply the new turboprops can be operated, I looked forward to seeing a nice reduction in the fare.

But no! Two years ago the Prestwick-Montreal return fare was about $382. Now it is about $426: an increase of over 11%. (Both these rates are "cheapest possible.")

Will these lovely new aircraft ever help the passenger where he needs help most—in his pocket? Or will they just be faster (which is desirable only after cheaper), more comfortable (perhaps) and safer (perhaps)?

Westmount, P.Q., Canada. A. O. H. NEILSON.

1,000-plus Airliners Now Ordered

IF the U.S. aircraft industry derives any inspiration from its electrical counterpart, I suppose we may soon expect them to protest about foreign-designed airliners violating the airspace and security of America?

Last month, one U.S. aviation magazine—enlarging on the theme that pure-jet and turboprop airliners were becoming increasingly difficult to sell in face of Continental competition—complained: "more than 100 foreign-designed aircraft are regularly flying the air routes of North and South America."

Although no particular airliner has yet been identified as a "threat" to U.S. security, the figures I have just gleaned on the potential home and export sales from eight well-known aircraft manufacturers show the underlying cause for the American industry's alarm:—

Aircraft	Total ordered	Home	Export	Export per cent.
Viscount (Britain)	405	86	319	78.8
Boeing 707 (U.S.A.)	187	129	58	31.0
Douglas DC-8 (U.S.A.)	143	106	37	25.9
Fokker Friendship (Holland) ..	99	14	85	85.8
Britannia (Britain)	74	58	16	21.4
Caravelle (France)	50	24	26	52.0
Vanguard (Britain)	40	20	20	50.0
Comet 4 (Britain)	33	25	8	24.2

From this chart it seems certain the principal offender (in the eyes of American salesmen) is our superb Viscount. With its total sales far outstripping the combined efforts of Boeing and Douglas, it augurs a rosy future for its stable companions the Vanguard and pure-jet VC.10.

Comparison between export and home sales, however, puts the Dutch-designed Friendship ahead of the Viscount by 7%. This is caused, no doubt, by the fact that the 39 Friendships ordered by American operators are being built under licence in the States by the U.S. Fairchild Corporation.

Evidently determined to maintain its secure transatlantic footing, the Fokker Co. is also starting a Friendship production line in Brazil.

So, while we in Britain and Holland appear to hold our own in the current sales race for turboprops, the Lockheed Electra (no figures available) seems to make future markets—with perhaps 700 turboprops already ordered—very uncertain.

More certainly clear to any crystal-gazing sales director or air correspondent is the fact that, with a total of more than 400 top-ranking pure-jet airliners on order, a globalwise saturation point has probably been reached.

St. Albans, Herts. W. M. RICHARDSON

An Ideal Hangar

WHILE reading a recent issue of THE AEROPLANE I noticed a suggestion that gliders may be included in future boat shows. While this appears to be "intruding" on the exhibition, it seems to be in order these days, an example being the profusion of boats at the Motor Show. Surely, then, it would not be stepping out of line to suggest that one witty hangar manufacturer enter one of his products, full-size, of course, at the next Ideal Home Exhibition.

Stanmore, Middx. I. P. MELTON.

Aroundabout

From My Favourite Line Book

Range Controller, Tarhuna range, Tripoli, to Valiant captain: "That bomb fell fifty yards from this hut—stand by while I check for casualties and damage." Interval of pregnant silence. Then "Clear to run up. The excitement here is intense."

*

Taken as Red. Do Russian squadrons have line books? If not, they should start right away with the report of one of their jet bomber pilots who gave as a reason for a forced landing: "I collided with a wild duck at 18,000 feet."

*

Pun for the Fun of it. D.H. Engines tell me that their star exhibit at the Paris Show will be a Metro Gnome.

*

Let's Face It. I like the wording on the very informative invitation to No.112 Sqn. Reunion, which is being held at the famous White Hart pub at Brasted on May 16. You're asked to delete the inapplicable lines in:—

I would like to attend but cannot because
I am married.
I have no money.
I am nowhere near Brasted.
I've got something better to do.

There will probably be those unfortunates who won't cross out anything.

*

Total Frustration. To me, "C. of A." is fast coming to mean "Change of Address," for every post brings its quota of readdressed mail from people who have not acted on the request set out on the card I sent them. Now comes the final outrage—the printers who produced the card have sent their account to the old address!

*

Spontaneous Humour Dept.

"I'm against all change, even if it's an improvement."

"Tact consists of knowing how far one can go too far."

*

by Gren

NOTES AND EVENTS

FUELLING IN GERMANY.—Seen here is the superstructure of a series of underground fuel tanks recently installed at Frankfurt Airport by the Esso Petroleum Co., Ltd. The tanks hold 25,000 gal. of fuel, and pipe-lines run from them to the aircraft bays on the airport apron.

NEW EQUIPMENT.—A De Laval 100-c.c. precision test tube centrifuge has been installed in the Firth Cleveland fuel flow test house, which was opened in June, 1958, by the Minister of Supply at the Treforest works of Simmons Aerocessories, Ltd. The centrifuge, which develops 10,000 *g*, will be used for measuring water content and sediment in the effluent aircraft fuels from water separators and filters.

HELLERMANN NEWS.—The first issue of a bi-monthly bulletin, published by Hellermann, Ltd., of Crawley, Sussex, has been distributed by the company. It deals with new products and modifications to existing equipment.

M.o.S. APPROVAL.—Ketay, Ltd., of Romford, has announced that M.o.S. Certificates of Technical Approval have been received for a number of synchros. The company was recently granted design approval under the M.o.S. instrument and electrical equipment design approval scheme.

PRICE REDUCTION. — Imperial Chemical Industries, Ltd., has reduced the prices of its Fluon polytetrafluoroethylene. The average cost of Fluon granular polymer since March, 1956, has been about £2 a lb. The new prices represent, in general, reductions of 13%. I.C.I. Plastics Division's Fluon range now includes granular polymer for moulding and extrusion, coagulated dispersion polymer for extrusion and dispersions for a wide variety of application.

PARIS SHOW. — The principal exhibits on the Napier stand at the Paris Aero Show at Le Bourget will be a sectioned Eland turboprop, a sectioned Gazelle free turbine, various Scorpion rocket engines and components of the helicopter rocket booster system.

AERONAUTICAL COURSES.—The City and Guilds of London Institute has prepared a new three-year part-time scheme of aeronautical craft courses designed to meet the needs of all categories of craft apprentice in the aircraft industry. It comes into force in technical colleges for the 1959-60 season and the first examinations will be held in 1960. Details (price 9d., including postage) may be obtained from the Institute, 76 Portland Place, London, W.1.

GERMAN FAIR.—Bristol Siddeley Engines, Ltd., will be exhibiting for the first time at this year's German Industries Fair, which opens in Hanover on April 26. Exhibits are to include the Orpheus and Viper turbojets, the Thor ramjet, P.181 turboshaft engine for helicopters, and the PR-23 controllable liquid-propellent rocket motor.

Company Notices

NEW COMPANIES

Blackburn Aircraft, Ltd. (624,347).—Private co. Reg. March 26. Cap. £100 in 10s. shs. Objects: To carry on the business of manufacturers of and dealers in aeroplanes, flying machines of all kinds, aeronautical apparatus, missiles, etc. Subscribers (each with one sh.): Gladys Crout and Marion Simmons, both secretaries, of 59-67 Gresham St., London, E.C.2. First directors to be appointed by subscribers. Solrs.: Linklaters and Paines, 59-67 Gresham St., London, E.C.2.

Blackburn Electronics, Ltd. (624,348).—Private co. Reg. March 26. Cap. £100 in 10s. shs. Objects: To carry on the business of electrical, radio, television, radar, mechanical, hydraulic and general engineers and contractors, etc. Other particulars as Blackburn Aircraft, Ltd.

Blackburn Engines, Ltd. (624,349).—Private co. Reg. March 26. Cap. £100 in 10s. shs. Objects: To carry on the business of manufacturers of and dealers in engines of all kinds and parts and components thereof, etc. Other particulars as Blackburn Aircraft, Ltd.

Fairey Aviation, Ltd. (624,388).—Private co. Reg. March 31. Cap. £1,000,000 in £1 shs. Objects: To enter into an agreement with the Fairey Co., Ltd., and to carry on business as aeronautical, mechanical, electrical, electronic and nuclear engineers, etc. Subscribers (each with one sh.): J. C. Macpherson, Greenways, South Approach, Moor Park, Northwood, Middx, company director; L. S. Dawkins, Abbots Gate, Kingsley Avenue, Camberley, Surrey, company secretary. First directors to be appointed by subscribers. Solrs.: Ashurst Morris Crisp and Co., London, E.C.2. Reg. off.: North Hyde Road, Hayes, Middx.

Overseas Aviation Engineering (G.B.), Ltd. (624,300).—Private co. Reg. March 26. Cap. £1,000 in £1 shs. Directors: Ronald Myhill, 29 Hill St., St. Helier, Jersey, C.I. Donald I. Seymour, 35 Fitzjames Avenue, London, W.14. Reg. off.: Panton House, Panton St., London, S.W.1.

New Patents

APPLICATIONS ACCEPTED

813,913.—Caillette, G.—"Aerodyne adapted for vertical take-off and landing."—Jan 23, 1956. (Jan. 28, 1955.)

814,136.—Rolls-Royce, Ltd.—"Jet nozzles for jet propulsion purposes."—March 4, 1957. (March 5, 1956.)

Applications open to public inspection on May 27, 1959; opposition period expires on Aug. 27, 1959.

814,308.—Fairey Aviation Co., Ltd.—"Aircraft controls."—April 25, 1957. (Jan. 25, 1956.)

814,291.—Fairey Aviaton Co., Ltd.—"Aircraft controls."—Aug. 21, 1956. (Aug. 23, 1955.)

814,450.—A. V. Roe and Co., Ltd.—"Tail-first aircraft."—March 9, 1955. (March 15, 1954.)

814,397.—Folland Aircraft, Ltd., and Page, R. K.—"Aircraft arrester gear."—Nov. 8, 1956. (Nov. 24, 1955.)

814,412.—Martin-Baker Aircraft Co., Ltd.—and Martin, J.—"Ejection seats for aircraft."—May 1, 1957. (Aug. 31, 1956.)

Applications open to public inspection on June 3, 1959; opposition period expires on Sept. 3, 1959.

Aviation Calendar

April 24-26.—Sales Week-end organized by W. S. Shackleton, Ltd., **Kidlington Aerodrome,** Oxford.

April 27.—R.Ae.S. Guided Flight Section lecture, "Basic Principles of Radar with Particular Reference to Aircraft and Missile Applications," by F. D. Boardman, at the Institute of Civil Engineers, Great George Street, **London,** S.W.1, at 18.00 hrs.

April 28-30. — Navigation Convention organized jointly by the British and French Institutes of Navigation and the Ausschuss für Funkortung, "The Place of Automation in Navigational Methods at Sea and in the Air," at **Paris.**

April 29.—R.Ae.S. Christchurch Branch A.G.M. and film show, at the King's Arms Hotel, **Christchurch,** at 19.30 hrs.

April 29.—Kronfeld Club talk, "Early Gliding," by B. Talbot-Weiss, at 74 Eccleston Square, **London,** S.W.1, at 20.00 hrs.

May 2.—British Interplanetary Society lecture, "Inertial Guidance and its Applications to Astronautics," by D. J. Cashmore (English Electric), at Caxton Hall, **London,** S.W.1, at 18.00 hrs.

May 2.—National Rally organized by the Duke of Bedford and the R.Ae.C., at **Woburn Abbey,** Beds.

May 5.—R.Ae.S. lecture, "The Potential Use of Aircraft for Agricultural Purposes," by R. H. Scott, in the library, 4 Hamilton Place, **London,** W.1, at 19.00 hrs.

May 5.—R.Ae.S. Luton Branch lecture, "Aircraft Carriers," by J. C. Lawrence, in the Napier senior staff canteen, **Luton Airport,** at 18.15 hrs.

May 6.—R.Ae.S., Weybridge Branch A.G.M., at the Vickers-Armstrongs (Aircraft), Ltd., sports pavilion, at **Byfleet,** at 19.00 hrs.

May 6.—Kronfeld Club talk, "Met. for the National Gliding Championships," by W. Wallington, at 74 Eccleston Square, **London,** S.W.1, at 20.00 hrs.

May 7.—R.Ae.S. Cambridge Branch lecture, "Some Aspects of Blind Landing Techniques," by W. J. Charnley at University Engineering Laboratories, **Cambridge,** at 20.15 hrs.

May 8.—Helic. Assn. of G.B. lecture, "Helicopter Noise Suppression," by H. B. Irving in the R.Ae.S. Library, 4 Hamilton Place, **London,** W.1, at 18.00 hrs.

May 8-10.—Channel Islands international air rally at **Jersey Airport.**

May 9-10.—British Women Pilots' Association flying week-end, at **Snoring Aerodrome,** Fakenham, Norfolk.

May 9-10.—National Glider Trade Fair, at **Lasham Gliding Centre,** near Alton, Hants.

May 9-18.—National Gliding Championships, at **Lasham Gliding Centre,** near Alton, Hants.

Personal Notices

BIRTHS

Ferry.—On April 2, at R.A.F. Duxford, to Mollie (*née* Barker), wife of Bill Ferry—a daughter (Elizabeth Anne).

Lillywhite.—On April 10, at Gloucestershire Royal Hospital, to Margaret, wife of Wg. Cdr. G. E. Lillywhite, R.A.F. (retd.)—a daughter.

Roxberry.—On April 11, to Ann (*née* Goulder), wife of Sqn. Ldr. D. K. Roxberry, R.A.F.—a daughter (Gillian Frances Anne).

Sankey.—On April 3, to Pamela (*née* Clarke), wife of Flt. Lt. C. V. Sankey, R.A.F.—a son.

MARRIAGES

Cheshire-Ryder.—On April 6, in Bombay, Gp. Capt. Leonard Cheshire, V.C., to Miss Sue Ryder.

Harrow-Hemsley.—On March 30, at St. Saviour's, Totland, I.o.W., Flt. Lt. John Harrow, R.A.F. Regiment, Geilenkirchen, to Miss Coral Hemsley, of Croydon.

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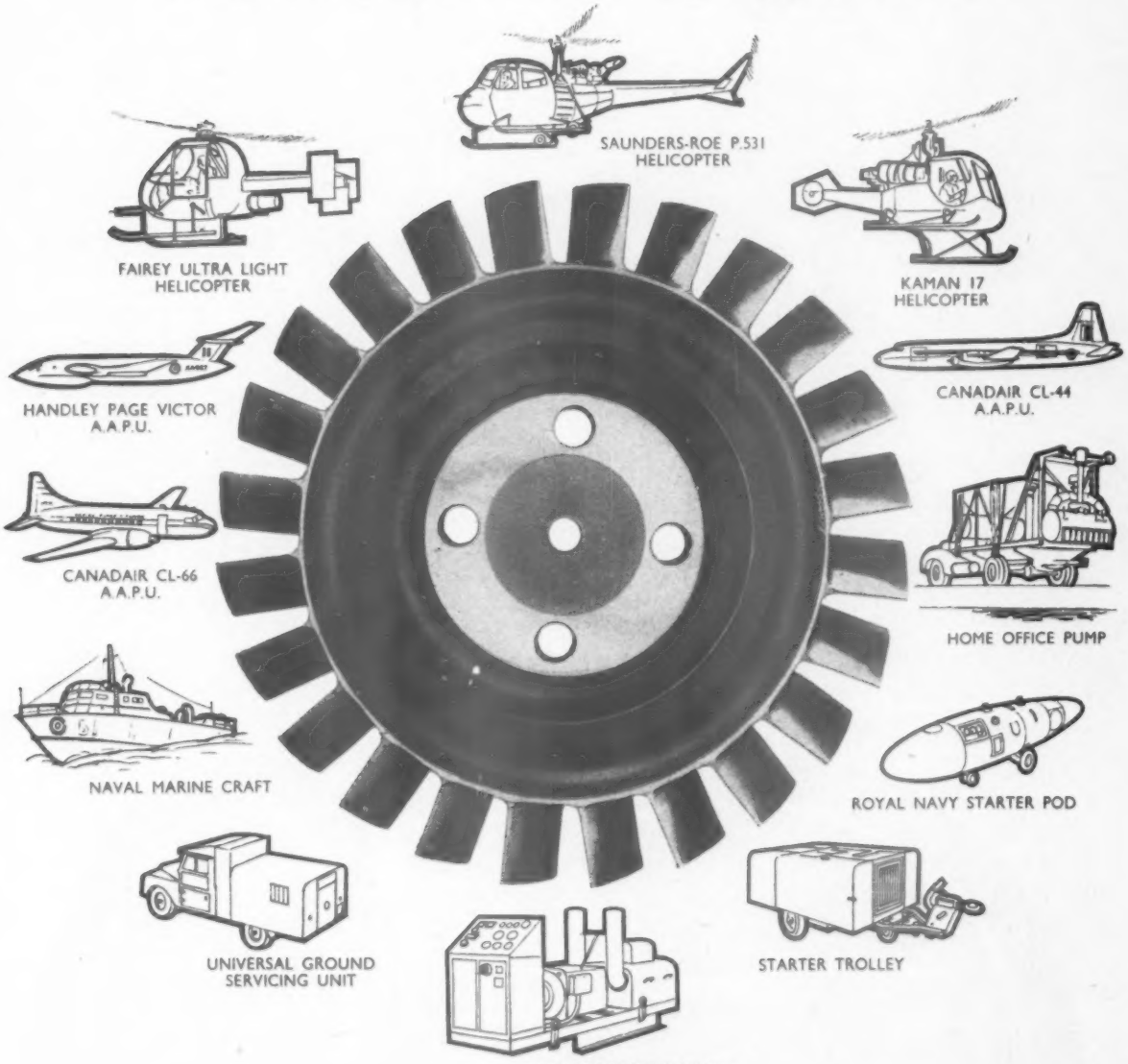

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Orders for any of the above aeroplanes can be accepted at the meeting, and in one or two instances the actual demonstrator aircraft on show can be purchased.

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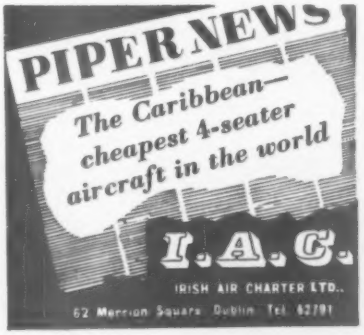

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APPLICATION NO. 2516 on the route Birmingham-Exeter-Newquay.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 486-3

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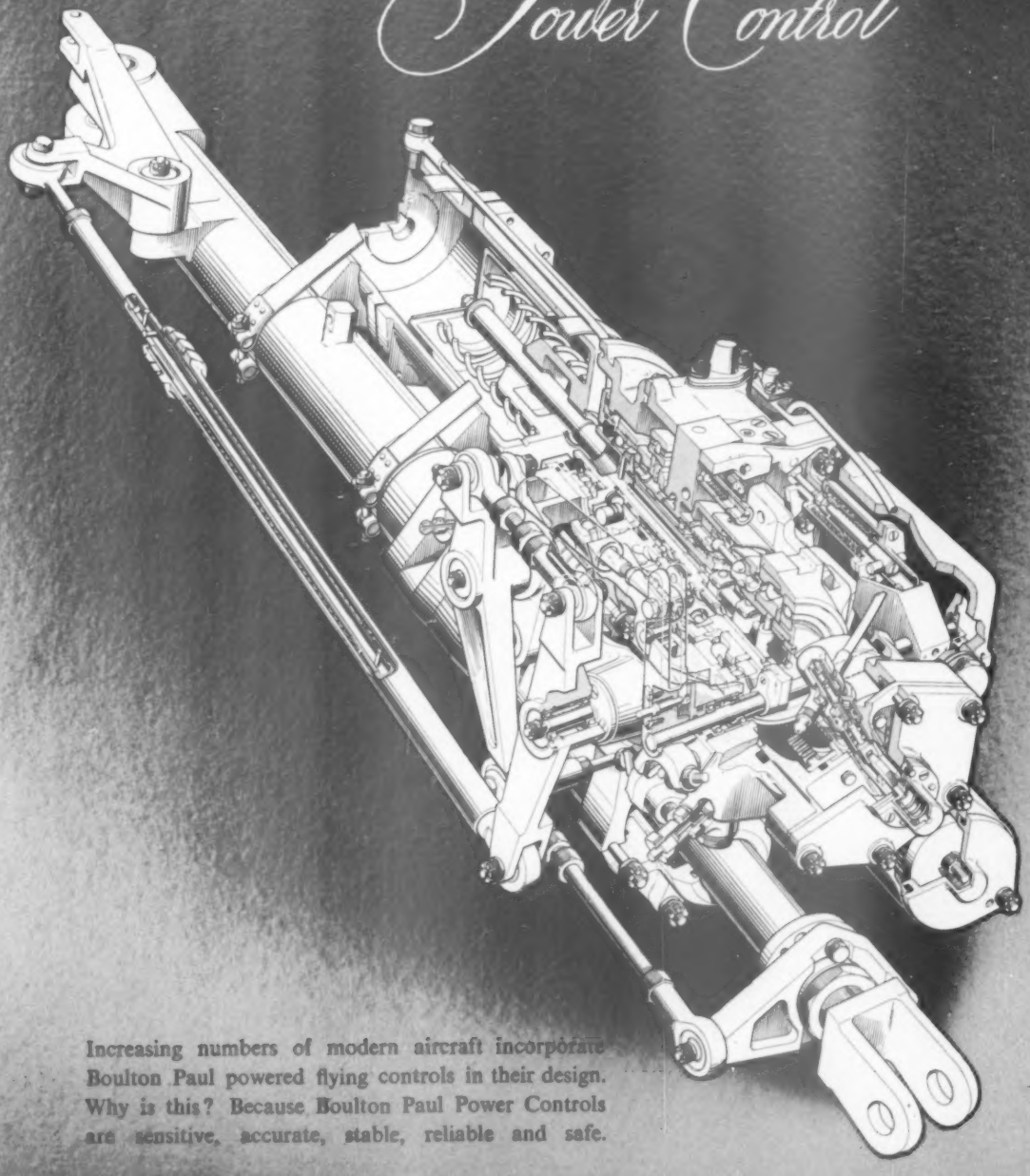

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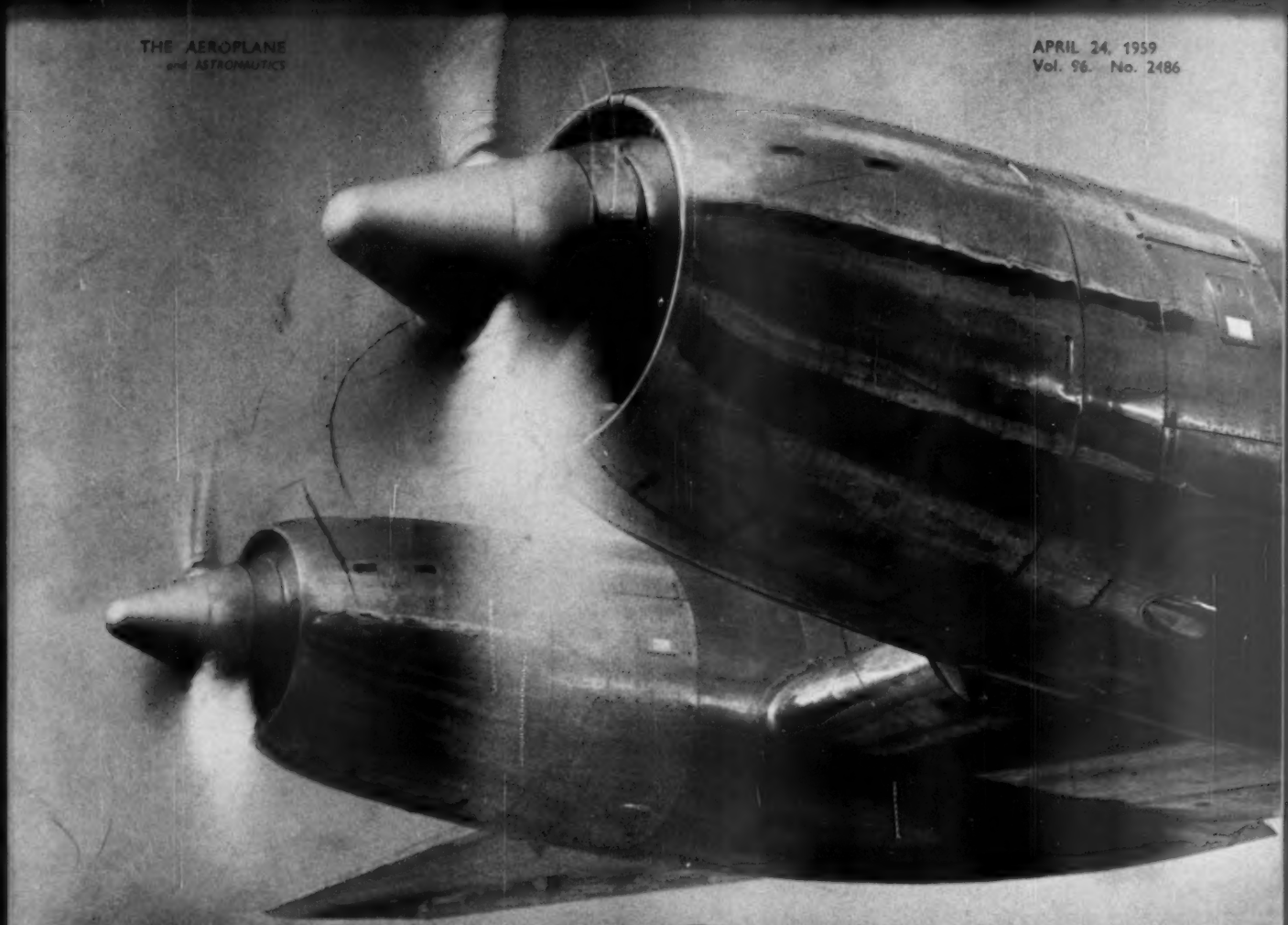

PROTEUS OVERHAUL LIFE

increases at rate achieved by no other aero-engine in the world

2,000 hours in under 2 years' service. 2,000 hours—this overhaul life figure was reached by Proteus 705 series in less than two years' service; a rate of increase in proved reliability never before achieved by any engine, piston or gas turbine. *No engine of comparable power has an overhaul life that even approaches this length.* Annual engine overhaul costs for BOAC's Britannia 102 aircraft have now been cut by 75% since the aircraft went into service.

Continued development, even lower fuel consumption. Further increases will give the Bristol Siddeley Proteus even longer overhaul life, entailing even lower operating costs. In addition, new versions of this engine—which already has a lower specific fuel consumption than any other gas turbine in civil or military use—are now giving even more power at an even lower specific fuel consumption.

Yet another Proteus achievement. Already flying over 2½ million miles a month on world trunk routes, Proteus-powered Britannias are being used by BOAC for the first-ever round-the-world jet airliner service—further proof of Proteus efficiency and reliability.

Bristol Siddeley

ENGINES LIMITED